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Preparedness

EFFICIENT aircraft and the air and ground crews to fly and maintain them are not things that can be pulled out of the hat, either in normal times or in those of national emergency. At this moment, after nearly five years of peace, the country is still feeling the effects of not being ready with the aircraft or the operating organization to take its place in world air commerce—an unfortunate though unavoidable position in which we find ourselves after a long total war. Looking back to the nineteen-thirties, when military and civil aircraft were relatively simple machines in spite of some three years of serious rearmament and the warning of Munich, we were unprepared when war came, and as a result suffered grievous setbacks and several near-to-mortal blows. Almost miraculously, as it seems now, extraordinary lulls occurred, and the country managed by almost superhuman efforts to use them to make up the most vital deficiencies in equipment, training and preparedness generally.

Last week (as reported on page 628) Lord Tedder spoke on air defence, and although there was little that was new in what he said, he characteristically related the various facts and aspects of his subject in such a straightforward and purposeful manner, that they took on a new importance. Perhaps the most remarkable advance made in warfare in the last decade has been in the speed and severity with which aircraft can strike, so it was fitting that much of what he said should have been concerned with preparedness. He pointed out that the potentialities of a sudden blow from the air are now so great that they might prove an irresistible temptation to an aggressor, particularly so since it is now apparent to all that long wars do not pay. "If, therefore," he said, "the free peoples can ensure that they are strong enough to gain time and make it clear to the world that they can defend themselves effectively during the opening phase of the war, I believe the risk of any would-be aggressor trying a *blitzkrieg* will be greatly reduced."

If countries fight again there will be little, if any, warning and no "phoney war" to follow. Of that we can be certain. How, then, should we prepare, bearing in mind that there is a limit to the amount measured in money, materials and manpower that a free country will or can afford in order to be ready to defend itself? Of this, incidentally, Lord Tedder says: "I do not myself believe that any single democratic country—even the United States—can or will pay for forces which, by themselves, will suffice to gain the time. . . Hence the association of nations now being formed under the Atlantic Pact."

Individually, nations must start by possessing a high morale, for without this there can be no high morale in their forces. The old spirit of waiting until one's back is to the wall before getting down to real business must be considered a thing of the past. The second aim should be to have available an efficient, balanced air force—fighters, fighter-bombers and bombers—together with the vast ground organization without which it is virtually impotent. Its duty is to gain control of the air, and to make sure that the battles of the air are fought as far distant as possible from home skies. Such assurance will be the strongest deterrent to any country with an aggressive nature.

As we have implied above, the need for preparedness is no monopoly of military aviation: on the economic battleground (where enemies may be friendly but no less determined) it is just as important to be ready and, again, good timing is a key factor. Requirements six to ten years hence, even though they must be based to some extent on intelligent guesswork, are a present concern for civil designers as for those working on military projects. The foresight which has led to the building of the Comets, the Brabazons and the Princess boats, stems from a desire to be ready with the aircraft when the occasion is ripe. There are those who consider one or all of these most important designs to be premature or even superfluous, but there are as many people in other countries which lack any counterpart who are wondering about their own preparedness for a few years hence.

The author, looking very much at home in the Hiller 360, goes solo. Its engine is the Franklin 335 "vertical flat six" of 178 h.p.

By C. Colin Cooper

British Pupil at a French School Flies an American–

"HANDS OFF" HELICOPTER

IN the author's view, the inherent-stability characteristics conferred by the Rotor-Matic Control System used in the Hiller 360 constitute a challenge to British helicopter manufacturers. In view of the very limited facilities for helicopter tuition in this country, his article will also be of interest to prospective pupils, though the question of currency restrictions must be borne in mind

RECENTLY I visited Paris for ten days in order to learn to fly the Hiller 360 helicopter. As time was limited, it was necessary to fall in with the weather, which was not too kind and eventually necessitated an inordinately large number of short sessions in one of the three Hiller Helicopters that are being operated in France by Helicop-Air, Ltd., the European distributing agents for United Helicopters, Inc., the manufacturers of the Hiller in California.

Helicop-Air was formed by Cdr. H. Boris, a dynamic personality who appears to work an eight-day week. The company is fortunate, also, in having Mr. Alan Bristow as chief pilot and helicopter advisor. Between them Boris and Bristow have managed during the past two months to demonstrate the aircraft in France, Holland, Belgium, Switzerland and Germany, execute an orange-grove-dusting contract in North Africa and start their pilot-training school at Cormeille, a large but little-used airfield 25 miles west of Paris. The school has aready trained a handful of pilots, mostly prospective customers or sub-agents to Helicop-Air in other European countries. The Hiller 360 has aroused considerable interest in Europe and it is thought that within another three or four months there will be at least ten of them on the Continent.

My first lesson was with Alan Bristow. We went up for half an hour, during which I was to familiarize myself with the different "feel" of the overhead cyclic control stick. Most people know that a helicopter has three controls—the cyclic control stick, which controls directional flight; the collective-pitch lever, that controls ascent and descent; and the rudder pedals, which, by altering the pitch of the tail rotor, control the machine in the yawing sense.

In the Hiller 360 the cyclic control stick hangs from over the pupils' left shoulder and, although the reaction to the movements of this stick are in the logical sense (i.e., stick forward, fly forward) it takes a little while to become accustomed to one's hand following an upward rather than a downward arc when pushing the stick forward.

Another difference in the flying controls of this helicopter is the absence of the now conventional twist-grip throttle on the collective-pitch lever. In most present-day helicopters the throttle is automatically opened as the collective pitch is increased, because the rotor absorbs more power at greater pitch. The pilot also has a means of making small adjustments above this automatic action, by operation of the twist-grip type throttle. On the Hiller, however, there is no twist grip, and the throttle is mounted in the form of a separate lever running parallel to the collective-pitch lever handle, so that it may easily be operated by the little fingers of the left hand, with a twisting motion of the wrist. In effect it is rather like juggling with two throttles of a twin-engined aircraft, only one lever controls the carburettor and the other the collective-pitch of the rotor blades; in theory, therefore, one lever controls the engine revs and the other the rotor r.p.m.

The pitch lever and throttle are so linked that increase in pitch results in an automatic opening of the throttle, but on the Hiller one is taught to fly by leading with the throttle whenever making an increase in pitch. Personally, I feel it is an asset to have complete control of your throttle at all times, especially during training, when a common

Mr. Alan Bristow (with papers) talks to a French pupil; on the left are the Munichs, senior and junior, engineers at the school. The "paddles" of the Rotor-Matic control are visible at the top of the picture.

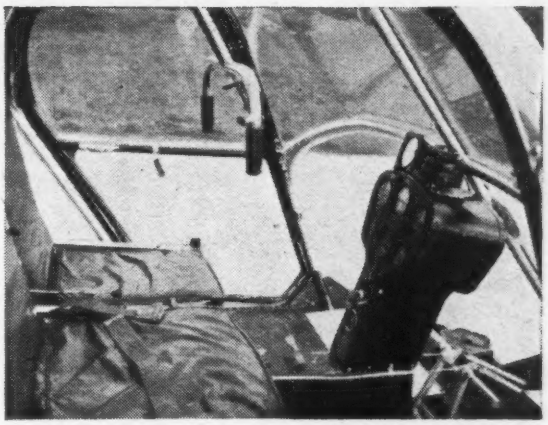
student-fault is over-pitching. (This is a condition in which the rotor blades have too great a collective incidence, and no matter how wide one opens the throttle there is not sufficient power in the engine, which becomes overloaded while the machine loses lift and sinks rapidly with rotor revs falling off alarmingly.) Correction on the Hiller is simple: the drill is to reduce pitch very rapidly, at the same time giving the engine full throttle; then, just when it appears too late to avoid sharp contact with the ground, one increases the pitch again. As this condition usually arises when the student is hovering at about 30ft above the ground, it can easily be realized that the manœuvre must be a quick one.

It was during this first flight in the 360 that I had my first introduction to the stability imparted by the Hiller Rotor-Matic control. The outstanding difference between the control system of the Hiller and that of other helicopters is these Rotor-Matic "paddles," which take the form of two aerofoil surfaces set on a small-diameter bar at right angles to, but revolving in the same plane as, the main rotor blades. The cyclic-control stick is connected, through a swashplate with these paddles, so that movement of the stick results in a cyclic increase or decrease in the pitch of the aerofoils. The resulting aerodynamic forces are transmitted to the main rotor and have the effect of tilting the rotor disc in the required direction.

Effect of the Control

The effect of the control is one of great stability. Watching carefully on the take-off, I followed through the motions with Bristow. The starting procedure seemed straightforward, and I noticed that almost as soon as the engine fired and began running smoothly the centrifugal clutch started to engage the blades. A brief warming-up at 2,000 engine r.p.m., and we were ready to take off. Speed was brought up to 2,500 r.p.m. and slight left rudder was applied; pitch and throttle were then increased simultaneously with a slight backward pressure on the control stick, pressure on the left rudder being increased to counteract the increasing engine torque. As soon as the machine became airborne at approximately 3,000 engine r.p.m., 310 rotor r.p.m., and 27-28in of manifold pressure, Bristow let go of the collective pitch and throttle; then, with a slight adjustment to the longitudinal trimming device on the cyclic control stick, he released his hold on that too. There we were, hovering hands-off with no tendency to stray or "fall away." Admittedly it was a very still day and we were directly into what little wind there was. Even so, the demonstration was most convincing, and later I learned, when trying to maintain a stationary hovering position, that if I made a mistake it was far better to let go of the controls and allow the machine to adjust itself, rather than to fight it back to normal. Naturally, as one gains experience this probability becomes less true, but with most students there is a tendency to over-control in the early stages.

After this familiarization we flew across the airfield at four feet altitude with an air speed of about 70 m.p.h.; trimmed for forward flight, we remained at this altitude for well over a mile, still hands-off. Then Bristow intimated that he was going to try a new experiment. Using only the collective-pitch and rudder controls, he climbed the machine to 500 feet, made a right-hand circuit and descended again to within ten feet of the ground. The complete circuit had been made without touching the cyclic control at all. A landing was not made, however, as we were still trimmed for forward flight. On trying the same thing with a left-hand circuit the machine was found to fall away badly as a result of the extra power necessary to turn against the torque of the engine.



The Hiller cockpit, showing bench-type seat-for-three and dual control column.

Nevertheless, from that day I have been completely sold on Rotor-Matic control.

Without a doubt, this method of control greatly simplifies pilot training, though it may lead to over-confidence. For myself, I had had very little previous flying experience—some 25 hours twelve months before—and yet, after only 2½ hours in the Hiller, I was quite capable of solo flight. In all, I had a little over 6½ hours flying at the Paris school and now feel confident to fly the machine anywhere under normal conditions. During this time I flew with Bristow 300 km across country and it may be said that neither of us had anything to do other than eat grapes and argue about our position.

It is to be hoped that, despite this country's present position with regard to dollar purchases, it will be permitted to bring one Hiller into England, if only to be tested at our research establishments. To my mind this new method of control deserves very serious consideration. By sub-contracting the construction of this machine, and

(*Concluded at foot of page* 612)

A spectacular impression of a Hiller 360 helicopter crop spraying in America.

HERE and THERE

Smithsonian Ceremony

ON Tuesday last, November 8th, the original Power Jets W1X was due to be presented to the American nation at a ceremony in the Smithsonian Institute, Washington, D.C. This pioneer turbo-jet arrived at New York in the *Queen Elizabeth* on the previous Thursday.

Naval Gas-Turbine

DEVELOPMENT-RUNNING of a 1,000 kW gas-turbine generator for use in ships is expected to begin early in 1951. The unit has been ordered by the Admiralty and is being built by W. H. Allen, Sons and Company, Ltd., in collaboration with the Bristol Aeroplane Company. It is reported that a two-stage turbine will be employed, with the second turbine driving the alternator.

Boost for Woomera

A REPORT from Sydney forecasts a major expansion of the research work undertaken at the Woomera rocket range in South Australia. This expansion, it is stated, will involve experiments with bombs, air fighting, explosives and radar anti-submarine devices; British scientific teams already in Australia will be strengthened.

Transatlantic Hat-Trick

STRATOCRUISERS have broken the transatlantic New York-London record three times within three weeks. A time of 9 hr 41 min recorded on October 24th was reduced by 20 min 12 days later. On November 6th, Capt. R. D. Fordyce, of P.A.A., flying the Clipper *Washington*, made the trip in 9 hr 12 min, assisted by an 80 m.p.h. tail-wind.

Groundwork

DURING the next few years, 500 Pakistani aircraft apprentices are to be trained by the R.A.F. at Halton and Cranwell. They will receive the same trade and recreational training as R.A.F. apprentices, with whom they will work and live side-by-side.

Jet Re-equipment

IN the House of Commons last week, the Air Minister, Mr. Henderson, was asked what percentage of the R.Aux.A.F. was using Spitfires, and what percentage would be re-equipped with jet fighters by December 31st, 1949. Mr. Henderson replied that 80 per cent of Auxiliary squadrons flew Spitfires; on present plans 35 per cent would have jet fighters by the end of the year. Re-equipment would be complete early in 1951.

There are 20 R.Aux.A.F. fighter squadrons, of which two have Meteors and two have Vampires. It may be assumed, therefore, that there will be three more all-jet Auxiliary squadrons in the near future.

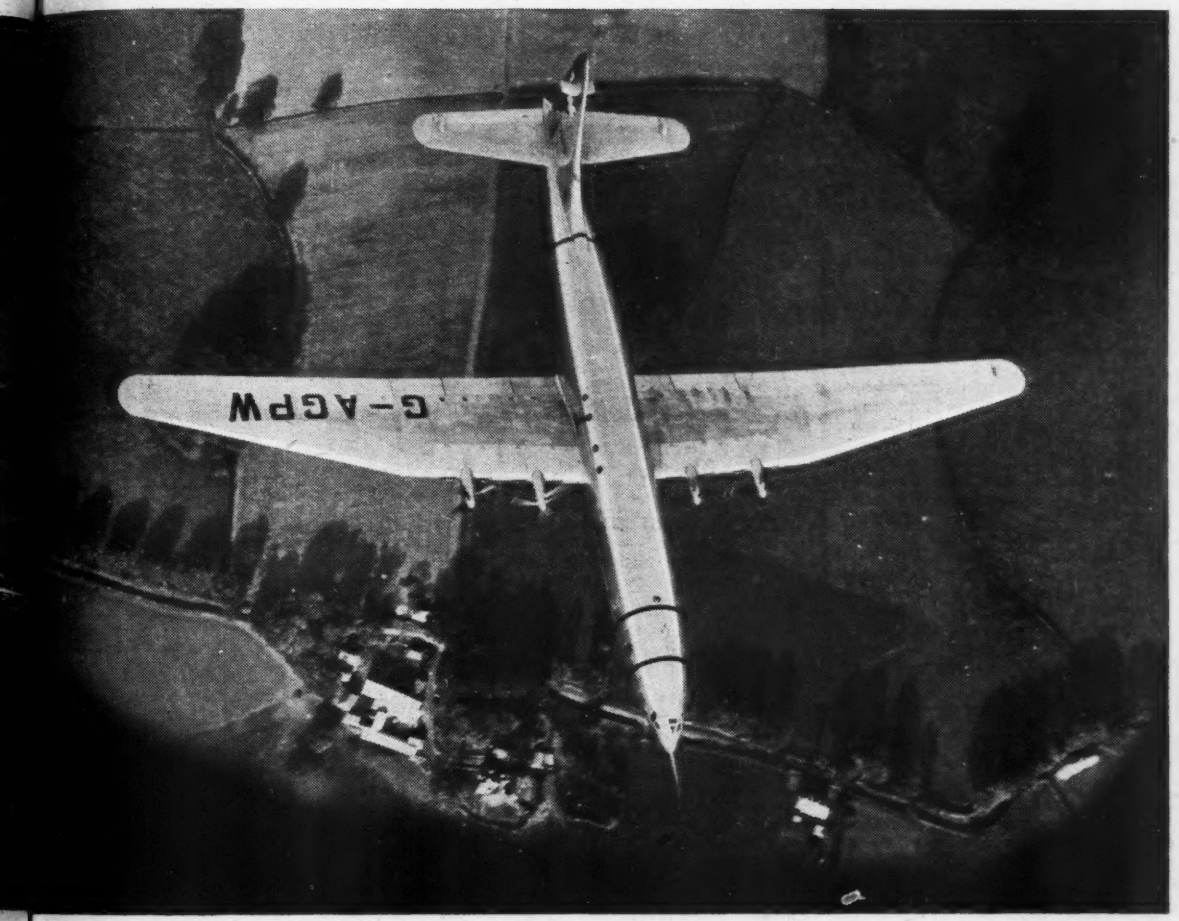
Sampling the Comet

AIR MARSHAL SIR ALEC CORYTON, Controller of Supplies (Air) at the Ministry of Supply, made a 1 hr 45 min flight in the D.H. Comet on Friday last. Other passengers during the flight, which was made from Hatfield, were Major F. B. Halford and Mr. R. E. Bishop, directors of the de Havilland Aircraft company, and Mr. A. Peters, of the D.H. design office. John Cunningham piloted the aircraft, which reached an altitude of 35,000 ft.

As we go to press, we learn that Lord Pakenham, the Minister of Civil Aviation, together with a number of his advisers, flew in the Comet last Monday and was "tremendously impressed."

Impressive Essay Prize

OFFICERS and cadets of the Women's Junior Air Corps are eligible to compete for a flight to Australia by B.O.A.C. and Qantas, which is being awarded by



GIANT IN FLIGHT: These first air-to-air photographs of the Bristol Brabazon I give a good indication of the huge prototype's fine proportions. The escorting Freighter in the view opposite serves to accentuate both the size and grace of the "Brab". Markings on the 177ft long fuselage are to assist interpretation of photographic test-records.

the Corps as a prize for an essay competition. Candidates will write an essay on English life, achievements and government, complete a general knowledge paper on Australia and supply a further essay discussing the future international benefits of civil aviation. It is hoped that an exchange visit by a member of a similar Australian organization will later be arranged.

Gloster Appointment

THE Gloster Aircraft Company, Ltd., announces that Mr. E. W. Shambrook, F.C.I.S., has been appointed to board. Mr. Shambrook joined the company as assistant secretary in 1935, having previously served with a London firm of chartered accountants. He was appointed secretary in 1940 and two years later became secretary of the associate company, A. W. Hawksley, Ltd., at that time engaged in aircraft production. Mr. Shambrook rejoined Gloster Aircraft in the same capacity in 1944.

Mr. E. W. Shambrook.

Lighter Than Fast

RANALD PORTEOUS, chief test pilot of Auster Aircraft, Ltd., pokes gentle fun at some of his high-speed contemporaries in an article in his company's house journal. Stating that the degree of progress reached in the very advanced Auster high-speed research programme may be a surprise to many, he reveals the existence of "the superlumic Auster, a logical development of the four-seat Autocar."

Porteous discusses the results of test flights outside the earth's atmosphere, and describes difficulties which arise when the speed of light is approached—"excessive glare when flying towards the light, whose relative velocity is doubled, and pitch darkness when flying downlight. . . . A further difficulty, due to the Soviet veto on discussions dealing with the Interplanetary Date Line, is that pilots carrying out tests at translumic speeds have often found themselves back at their base before they have started."

Swings and Roundabouts

FOLLOWING the breach between Yugoslavia and Russia, a ban on the export of British and American aircraft, engines and fuel to Yugoslavia has been relaxed; trade in these materials is expected to be resumed shortly. A second agreement between Britain and America is likely to restrict the sale to Communist China of aviation spirit and other goods which might find their way behind the Iron Curtain. Chinese Nationalist forces, on the other hand, recently received the first delivery of 100 North American Mitchells, flown from the U.S. to Formosa by American aircrews. U.S.A.F. jet fighters are reported to have escorted the Mitchells on the last lap of their journey, which was over Communist-held territory.

Mixed Grill

A B-17 Fortress and a Dakota, followed by a formation of 30 Spitfires and Messerschmitts (presumably Me109s) are reported to have flown over Tel Aviv on November 3rd. This fly-past commemorated what is described as the second anniversary of the Israeli Air Force.

Australian Jet Production

IT was reported some time ago that Australia was likely to undertake production of the Hawker P.1040, land version of the Sea Hawk. The Australian journal *Aircraft* now suggests, however, that the Commonwealth Cabinet is considering the Hawker P.1052 in place of the earlier machine. Although the

HERE AND THERE ...

swept-wing P.1052 was developed as an experimental research aircraft, there would appear to be no major obstacle to its use as a land-based fighter. Australian production of the English Electric Canberra jet bomber, says the journal, may take place at the Beaufort works of the de Havilland Aircraft Company of Australia.

FORTY YEARS BACK

"It was on Saturday last that Mr. J. T. C. Moore-Brabazon succeeded in fulfilling the conditions of the *Daily Mail* £1,000 prize for the first circular mile flown on a British machine, and his mount was the Short biplane with which he has been experimenting for some time at the flying ground of the Aero Club at Shellbeach. . . . He understands the tuning-up and adjustment of the motor as well as any mechanician . . . he is fearless, with just that dash of recklessness that one admires while still deploring it—that touch of recklessness which alone can make a pioneer aviator." — *From "Flight" of November 6th, 1909.*

U.S. Safety Awards

THE Flight Safety Foundation of New York has announced the four 1949 winners of its annual awards in recognition of services which have demonstrated their value, for not less than a year, in achieving safer utilization of aircraft. The awards are sponsored by the journal *Aviation Week*.

Recipients of the awards are: Leonard M. Greene, president of the Safe Flight Instrument Company, for the stall-warning indicator developed by his company; Hugh de Haven, of the Cornell Committee for Air Safety Research, for intensive study of safe-flight design principles; American Airlines and United Air Lines. The latter companies produced films dealing with, respectively, aircrew accident procedure and safety in over-water flying.

TRIPLE THRUST: The first flight of the Martin XB-51—described as "spectacular but uneventful"—was made at Patuxent on October 28th, and lasted 34 minutes. Designed for tactical operation, and classed as a light bomber, the XB-51 is powered by three General Electric J-47 turbojets, each giving 5,200 lb thrust.

Mosquitoes for Sweden

THE Fairey Aviation Company, in co-operation with the de Havilland Aircraft Company, recently completed the overhaul, modification and testing of 45 Mosquito 19 night fighters for the Royal Swedish Air Force. This work, which has been undertaken at Ringway (the flight test and servicing centre for Fairey's main northern factory at Stockport) follows similar contracts for conversion and overhaul of 132 Mosquitoes for Turkey and five for the Dominican Republic.

Fairey test pilots at Ringway are now testing the last of 124 Yorks—formerly on the Air Lift—which have been overhauled for the R.A.F. This contract is stated to be the largest ever awarded by the Service to a civil maintenance organization.

EMBEDDED: For flight-testing the Phœbus—the gas-producer section of the Bristol Proteus turboprop—the turbojet unit is neatly installed (as mentioned on p. 595 last week) in the bomb-bay of a Lincoln flying test-bed.

NEWS IN BRIEF

THE Indonesian Chief of Air Staff, Air Vice-Commodore Suryadarma, stated recently that Indonesia plans to build up an air force of five fighter squadrons and up to five transport squadrons, following the transfer of sovereignty by Holland.

* * *

The index to Volume LV of *Flight* (January to June, 1949) is now available and may be obtained from the Flight Publishing Co., Ltd., Dorset House, Stamford Street, London, S.E.1, at a cost of 1s 1½d, including postage.

* * *

Henry Hughes and Sons, Ltd., report that their G.3 gyro-magnetic compass is fitted in the prototypes of a number of important new aircraft, including the Brabazon I, Ambassador I, Comet, Viscount, Apollo and Canberra.

* * *

A recent report from Istanbul, which appeared in a daily newspaper, said that a first contingent of 40 Vampires for the Turkish Air Force was expected to arrive there shortly. The de Havilland Aircraft Company states, however, that it has no knowledge of such orders.

* * *

Stated to be "already widely used as a permanent protective finish on automobile and aircraft electric cables," and to have high flame-retarding and oil-resistant qualities, "Kling" cellulose acetate lacquers are the subject of a leaflet issued by the East Anglia Lacquer Co., Ltd., Street One, Aycliffe, Darlington.

* * *

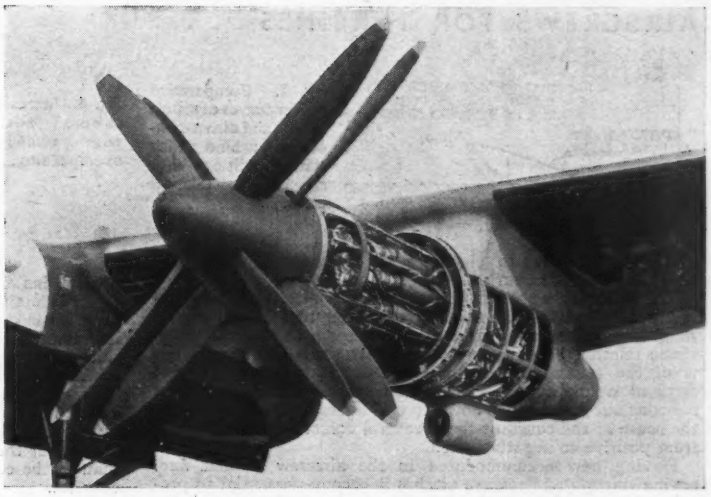
Results of recent examinations constitute a record in the history of the Saunders-Roe apprentice school. In taking the Higher National Certificate, twelve apprentices passed in mechanical engineering, two with distinctions in "Strength of Materials and Structure," and in the Ordinary National Certificate examination 18 apprentices passed in mechanical engineering and four in electrical engineering.

B S

AIRSCREWS FOR TURBINES

A Review of Current Progress: New Problems of Pitch-control and Blade Design

By L. G. Fairhurst, M.I.Mech.E.



Counter-rotating airscrews on the Armstrong Siddeley Python.

THIS review, prepared by the Chief Engineer of Rotol, Ltd., is a special contribution to the forthcoming new edition of "Gas Turbines and Jet Propulsion," by G. Geoffrey Smith, and will appear in it with certain illustrations additional to those reproduced here. Mr. Fairhurst shows how, though the development of the turboprop has presented airscrew designers with a number of new problems, it has also relieved them of others, such as those concerned with blade strength in relation to the stresses imposed by the reciprocating engine.

AIRSCREWS for reciprocating engines have for a number of years embodied such features as constant-speeding, feathering and, more recently, reverse pitch for use in braking. The use of the airscrew in "windmilling" pitch for dive-braking has been experimented with on the reciprocating engines of dive bombers, but to date has found no definite application on this type of power unit. Gas-turbine power units have created for the airscrew designer problems which had not arisen in reciprocating engines, and have demanded a completely new range of airscrews for power outputs of from 1,000 h.p. to 7,000 h.p.

The fact that there are at present three distinct basic types of turboprop units has contributed by no mean amount to existing airscrew design problems. The three consist of the "direct connected," "compounded compressor" and "free turbine" types shown in Fig. 1. The characteristics of each type demand special mechanical features in the airscrew design. Such features, and the associated aerodynamic, vibration, and noise-reduction problems, are dealt with subsequently under the various engine types. One feature common to all power units having a central air intake is the reduction in bulk of the airscrew hub in order to house it inside the smaller-diameter spinner associated with this type of intake. This requirement in itself involved considerable re-design by reason of the need to cramp the operating mechanism into a smaller compass.

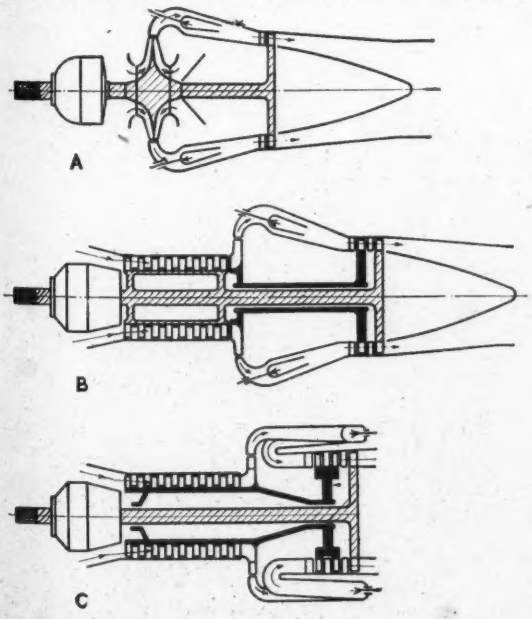


Fig. 1. Operation of the three basic types of turboprop units.
(A) Direct-connected: Turbine drives compressor and airscrew.
(B) Compounded compressor: First turbine stage drives free radial compressor; second turbine stage drives axial compressor and airscrew.
(C) Free turbine: First and second turbine stages drive free compressor; third turbine stage drives airscrews.

Direct-connected turbine.—This type of power unit demands, in addition to the normal fine pitch-angle for take-off, a still finer pitch for starting purposes. The requirement can better be appreciated by reference to Fig. 2, which shows that the piston engine, under static conditions, is capable of starting and accelerating the airscrew with the latter set at take-off pitch. The direct-connected turbine curve, falling below the airscrew power-absorption curve, shows that the turboprop cannot start and accelerate the airscrew at normal fine pitch angle as its power equals the airscrew power-absorption only at maximum r.p.m. Thus, it is necessary to provide an additional pitch angle below normal fine—usually between 0 deg and +6 deg. Furthermore, it is essential to interconnect the airscrew-pitch and engine-fuel controls; otherwise, if too low an r.p.m. be selected on the airscrew for a given engine power after starting, the airscrew will overlead the engine and result in stalling and overheating.

Fig. 3 shows the relationship between the engine and airscrew on a sudden acceleration of the engine from slow running to maximum r.p.m. As the airscrew control would be set to call for maximum r.p.m., no change from starting-pitch angle would occur until the engine slightly over-speeded beyond its maximum r.p.m., at which point the pitch angle would then have to coarsen rapidly in order to hold the permissible maximum r.p.m. figure. Under such conditions some over- and under-swing about maximum r.p.m. would be unavoidable. Interconnection of airscrew-pitch and fuel controls is necessary in order to

AIRSCREWS FOR TURBINES . . .

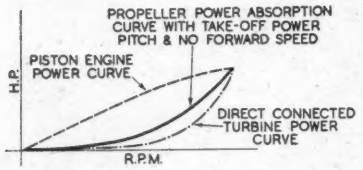

PROPELLER POWER ABSORPTION CURVE WITH TAKE-OFF POWER PITCH & NO FORWARD SPEED
PISTON ENGINE POWER CURVE
H.P.
DIRECT CONNECTED TURBINE POWER CURVE
R.P.M.

Fig. 2. Comparative power curves of piston engine and direct-connected turbine under static conditions with airscrew in take-off pitch.

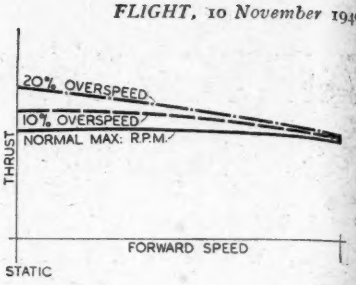


Fig. 4. Increase in take-off thrust with temporary overspeeding.

allow the airscrew to change pitch progressively with the engine up to maximum r.p.m.

The need for close association between airscrew pitch and fuel control makes it essential to extend the constant-speed range down to starting pitch to guarantee a correct and automatic relation between engine and airscrew. If the airscrew is of the reverse-pitch type, with provision for a negative angle of around 25 deg, it becomes necessary further to extend the constant-speed range down to this figure and also to reverse the sense of the constant-speed control coincident with passing from positive to negative pitch.

Having now accommodated in the airscrew normal fine, engine starting and reverse pitches it becomes essential to provide automatically removable safety locks at the normal fine and starting pitches in order to prevent the airscrew blades fining-off to too low a pitch in the event of airscrew-control or engine failure in flight. Either failure, with an airscrew moving suddenly into starting pitch, would not only seriously

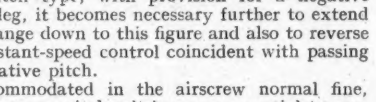


Fig. 3. Relation of airscrew speed and pitch under rapid acceleration from slow running to maximum r.p.m.

over-rev the airscrew and engine but would also impose on the aircraft a very heavy drag from the former.

In a non-reversing airscrew the sequential operation of the automatic safety-lock is as follows: The engine is initially started with the airscrew in super-fine pitch (from 0 deg to 6 deg), the blades remaining in this pitch until starting has been accomplished. On the engine being opened up to full power and r.p.m. the blades coarsen until they reach the take-off fine-pitch angle associated with such power and r.p.m. At the same time they "latch-over" the safety lock, which remains latched throughout flight. At the instant the undercarriage legs are loaded, the lock is automatically removed by electro-hydraulic means and the airscrew can now constant-speed between normal fine and starting pitch, according to the taxying conditions required.

While engine designers generally are striving to make their engine stalling characteristics such that the normal fine-pitch lock need not be removed until after touch-down it may, for the time being, be essential on certain types to break the lock on the approach.

In the case of a reversing airscrew, a second lock is fitted at starting pitch which can also be automatically removed after the aircraft has landed and the reverse-pitch control operated.

As a further safeguard after engine failure, designers are interconnecting the torque-meter with the airscrew-feathering control. Immediately negative torque occurs in the engine the airscrew pitch is automatically coarsened instead of following its natural tendency to "fine off."

Compounded Compressor.—In so far as airscrew design is concerned, this type functions on the lines of the piston engine. It is, therefore, possible to start and accelerate the unit up to maximum power and r.p.m. with the airscrew set at normal take-off fine pitch. Only when pitch angles below normal fine are required, as for braking, is there any necessity to include the automatically controlled safety lock. Aircraft drag induced by a windmilling airscrew after engine failure is less than for an equivalent size of direct-connected turbine, since there is less inertia in the "half compressor" allied to the airscrew.

Free Turbine.—As in the previous case, this unit does not demand a special fine pitch for starting. Aircraft drag induced by a windmilling airscrew after engine failure is only a fraction of that for the direct-connected type and still considerably less than in the compounded compressor type. This is due to the very low inertia of the airscrew-shaft system, as there is only a turbine wheel to rotate. On account of this low inertia, however, there is a greater tendency to overspeed the airscrew and free turbine after failure of airscrew control system, particularly at speeds approaching cruising. To prevent this overspeeding an automatically controlled safety lock can be incorporated just below the cruising pitch, so that the airscrew will "sit" against the lock after failure; the pitch is sufficiently coarse to prevent overspeeding. Conversely, this characteristic can be turned to advantage by the airscrew designer as it is relatively easy to provide a temporary overspeed in r.p.m. for take-off. The increase in take-off thrust from this temporary expedient is most valuable in cases where airscrew speed is held down for reasons of reduced noise at cruising conditions. Fig. 4 shows the increase in take-off thrust afforded by temporary overspeeds of 10 per cent to 20 per cent above normal maximum r.p.m.

Dive Braking

Airscrews for Dive-bombing Aircraft.—The gas turbine will no doubt be the power unit for which the airscrew designer will develop the windmilling-pitch feature to give added braking effect in the dive. The blade pitch angle selected is that at which the airscrew is very inefficient as a windmill, developing high drag for a small windmilling input power to the engine. On the heavier types of naval dive-bombers the normal dive-brake controls have been found to be too heavy both in control load and avoirdupois. It has been shown that on an aircraft of 26,000 lb all-up weight the airscrew can provide a braking effort of 14,000 lb in the dive. The three different types of turbine units react differently on the airscrew design for dive braking, since the rate of pitch-change into and out of diving

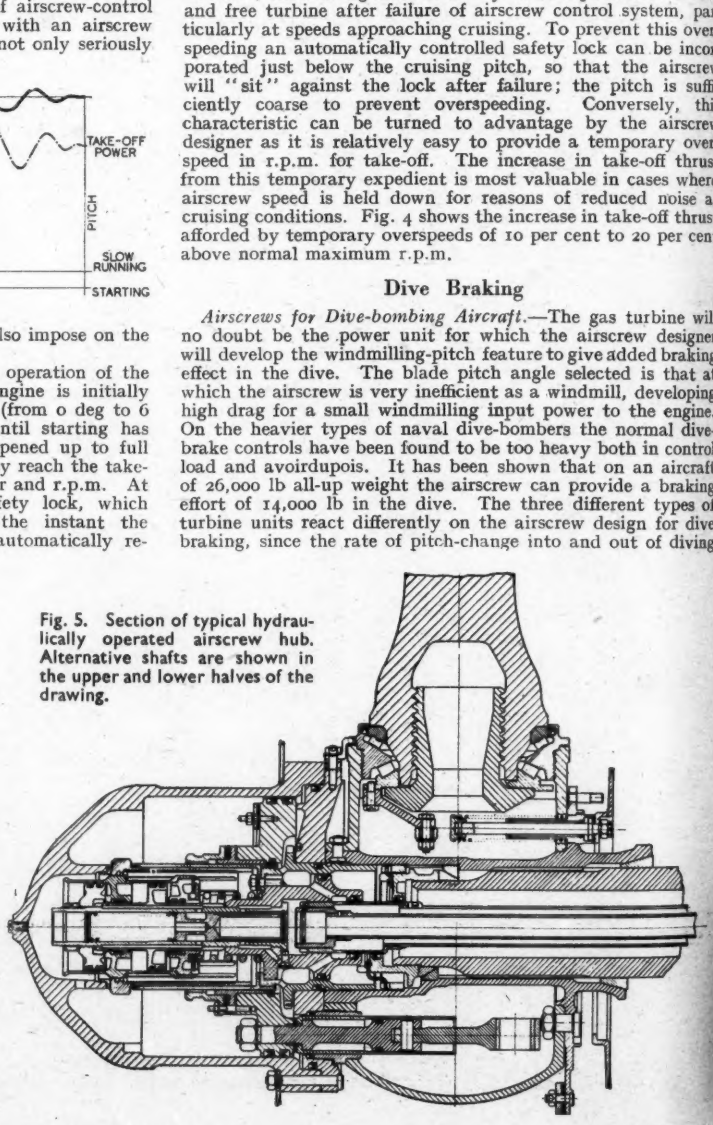


Fig. 5. Section of typical hydraulically operated airscrew hub. Alternative shafts are shown in the upper and lower halves of the drawing.

AIRSCREWS FOR TURBINES . . .

pitch varies with the engine type. The direct-connected turbine with maximum inertia in the airscrew shaft system requires around 40-50 deg per second to prevent serious overspeeding when passing through the pitch angle at which the airscrew is a comparatively efficient windmill. As the inertia in the airscrew system is reduced higher rates of pitch-change are necessary —up to 70-80 deg/sec for the compounded-compressor engine and 100-120 deg/sec for the free turbine.

Mechanical Features of Turbine Airscrews.—A typical airscrew hub and a circuit design for a turboprop airscrew are shown in Figs. 5 and 6 respectively. The hub drawing reveals the effort made to reduce the height of the hub sockets to enable them to be housed within a small-diameter spinner. The mechanism of the safety locks is shown inside the operating cylinder, the locks being automatically made and removed by employing increased oil pressure from the airscrew-control unit.

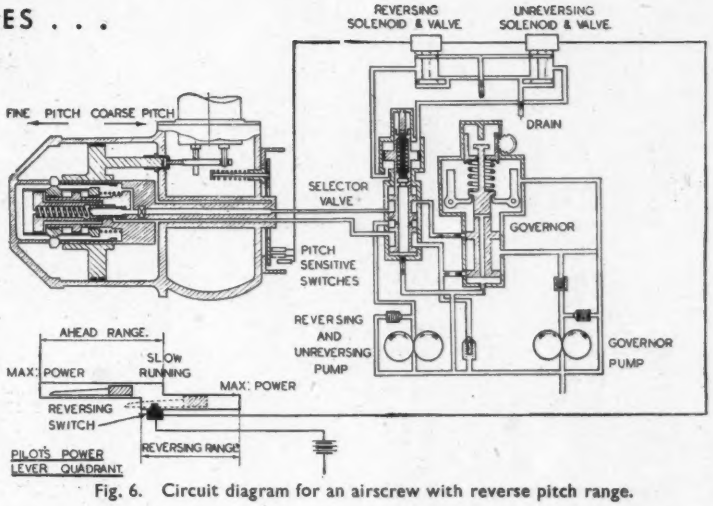


Fig. 6. Circuit diagram for an airscrew with reverse pitch range.

The circuit diagram (Fig. 6) indicates the complete airscrew control system, including the reversing feature. Electric solenoid control is shown for operating the various change-over hydraulic valves used in the reversing and lock-removal mechanism.

Airscrew Aerodynamic Design.—A characteristic of the gas turbine is the close ratio between maximum power r.p.m. and cruising power r.p.m. Generally the cruising r.p.m. is 90 per cent of maximum as against 80-85 per cent in the case of the piston engine. In civil aircraft the tip speed of the airscrew is usually reduced in order to minimize noise. With the single-speed reduction gear, this lowering of the airscrew cruising r.p.m. also lowers its take-off r.p.m. and hence jeopardizes take-off thrust, due to the greater stalling tendency in the blades. This effect is more pronounced in the gas turbine than in the piston engine, owing to the closeness of cruising and take-off r.p.m. referred to above.

In order to provide compensation it is necessary to obtain (so far as is practicable without affecting cruising performance) a greater blade area or activity factor. The difficulty of compromising between take-off and cruise conditions has been a problem in the industry for many years and two-speed gears have been mooted at various times. As mentioned earlier, the free turbine has great possibilities in this respect, as temporary overspeeding of the airscrew turbine can be accomplished without affecting the compressor portion of the engine. It provides, in effect, an infinitely variable gear.

The higher forward speeds arising from adoption of the gas turbine have accelerated the development of blade aerofoils of higher aerodynamic efficiency. N.A.C.A. Series 16 sections are now being widely used on all the latest turbine airscrew projects and give considerably increased thrusts for take-off and climb, and increased cruising efficiency.

Further developments include the swept-back blade. The critical speed at which high drag-losses occur in a blade of this type is around 25 per cent higher than hitherto. The use of boundary-layer suction on the airscrew blade is also receiving very serious consideration, as an effective reduction in drag of the section can be thus achieved. A blade of hollow construction lends itself excellently for utilizing the inherent centrifugal "pumping" effect in order to suck away the boundary layer.

Airscrew Noise Problems.—The gas turbine, being in itself a less noisy power unit than the piston engine, has forced the airscrew designer to make a serious study of noise-level reduction.

Airscrew noise is in two forms, rotational and vortex. The noise from rotational effects contains the greater acoustic energy and is heard as a low-pitched roar. So far, the only method of reduction is to operate at lower cruising r.p.m. While this gives a most effective lowering of the noise level, the use of a single reduction gear between engine and airscrew seriously jeopardizes the take-off thrust and demands in most cases a compromise. The frequency of the rotational noise is a product of the r.p.m. and the number of blades.

Vortex noise is caused by turbulent air creating vortices which are shed by the airscrew blades in the vicinity of the tips. So far very little has been or, in the present state of knowledge, can be done to reduce this form of noise, but since it involves far less acoustic energy the problem has not the immediate importance of the rotational effect.

Acceptable noise levels laid down for modern aircraft lie between 98 and 100 decibels.

Dual Rotation

Counter-rotating and Coaxial Airscrews.—The higher powers attainable with gas turbines have brought to the fore the necessity for dual-rotation airscrews. For power units of 5,000 to 7,000 h.p. counter-rotating or coaxial types are inescapable, as the aircraft designer is still reluctant to accommodate the diameters—of 17 or 18ft—by which single rotation could be retained. Above the 5,000 h.p. mark the present practice is to couple two engines of equal power. The type of turbine determines the choice between counter-rotating or coaxial designs. It is the usual practice to use the counter-rotating arrangement on coupled free turbines and the coaxial arrangement on coupled direct-connected turbines. This difference in airscrew type, in the case of the coupled direct-connected turbine, is due to the necessity of having each half of the airscrew independently driven by its own engine. Thus, in the event of one engine failing, the good engine does not have to expend 70 per cent of its normal power in driving the dead engine through the gearing. With the free turbine, the power to drive the dead engine is relatively negligible.

Weights of Turbine Airscrews.—Being basically lighter in weight than its reciprocating-engine counterpart, the gas turbine has inspired the airscrew designer to provide lighter airscrews. The greatest saving can be achieved in the blades, where, on account of the absence of torsional vibrations from the power unit, considerable reduction in the thickness of section is possible. A certain degree of weight reduction can also be achieved in the hub structure, again owing to the absence of torsional stresses. Specific weights of airscrews for gas turbines vary between 0.15 to 0.18 lb/h.p. for single rotation and 0.18 to 0.22 lb/h.p.

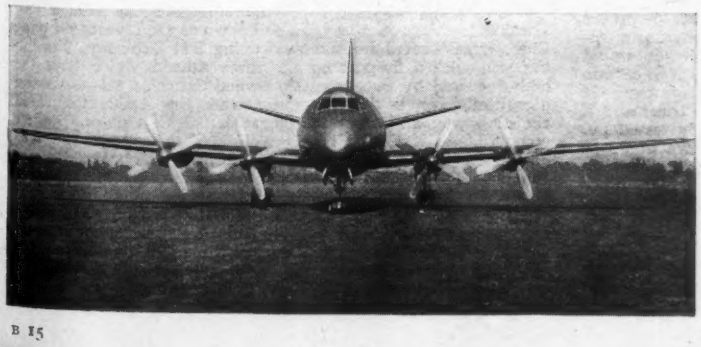


Fig. 7. The first medium-range airliner powered by airscrew turbines, the Vickers Viscount (four Rolls-Royce Darts).

AIRSCREWS FOR TURBINES . . .

in the case of airscrews of the dual rotating patterns.

Airscrew-blade Materials.—Solid duralumin blades are still widely used for gas turbines, their life having been extended by the elimination of torsional stresses. A gas turbine enables the blade to be designed purely from the aerodynamic aspect, whereas previously the blade-section modulii had to be increased in order to keep down the torsional stresses induced from the crankshaft system of the reciprocating engine.

At diameters of 16ft and beyond, the hollow steel blade shows considerable weight saving, and is therefore highly desirable in these large sizes. Moreover, it permits of much wider blade chords without exceptional weight increase, and it is possible for a given power to use three blades in hollow steel as against four in solid duralumin, thereby reducing still further the overall weight. The hollow steel blade also facilitates the use of internal de-icing systems, while durability of the blade is also greatly improved by the use of hollow steel construction.

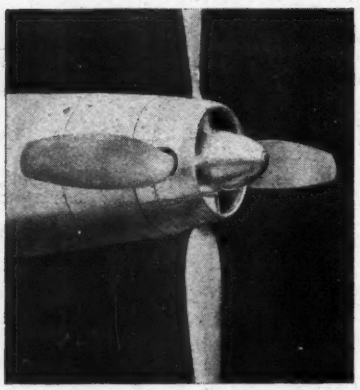


Fig. 8. Ducted spinner for the Napier Naiad.

Airscrew Synchronization. — Development of automatic - airscrew synchronization has now progressed sufficiently to enable it to be adopted as a standard feature on all multi-engined aircraft. There is little doubt that the airscrew control systems now used for turboprop power units will in future be embodied in the main control system instead of being an added component. The synchronizing system opens up the possibility of all-electric control to the airscrew constant-speed unit, which would prove a big advantage on large aircraft with long and tortuous control runs.

Ducted Spinners.—A development in airscrew design for gas turbines, the value of which has still to be proved, is the ducting of the spinner to improve conditions of air entry into the compressor. The conventional central spinner is suspected of "spilling" the air in front of the intake and may eventually have an outer shell so that an annulus or duct is formed between the two. In such designs the blade roots within the annulus are carefully streamlined by aerofoil-shaped cuffs which, at the same time, provide the supports for carrying the outer shell.

Supersonic Airscrews.—The high rotational speed of gas turbines has suggested the possibility of supersonic airscrews. Fig. 9 shows the drag coefficient phenomenon of an aerofoil section at high forward speeds, wherein the drag coefficient rises abruptly between 650 and 750 m.p.h. and then falls again beyond these speeds. This phenomenon suggests that

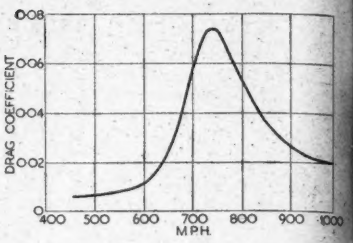


Fig. 9. Variation of drag coefficient with forward speed at sea level.

if the whole length of the airscrew blade could be made to operate at supersonic helical speed, the application of the airscrew could be extended to the higher aircraft speeds associated with the turbine unit. It would appear, therefore, that aircraft speeds of 600 m.p.h., together with the high rotational speeds permissible with the turbine, might materially assist in obtaining supersonic operation of the airscrew instead of being an embarrassment to the airscrew-blade designer.

Theoretical studies of an airscrew operating under supersonic conditions have indicated cruising and top-speed efficiencies of around 70 per cent. Since, however, the higher rotational speed limits the airscrew diameter on constructional grounds, the take-off thrust falls to around 1 lb/h.p. instead of the usual 2.5-3.5 lb/h.p. In spite of the latter disability the supersonic airscrew well warrants further study and wind-tunnel research.

Ducted Fans.—For aircraft speeds of the order of 600 m.p.h. the quantity of air dealt with by an orthodox airscrew is very large and the acceleration impressed upon it very small. In other words, jet efficiencies approach 1 and losses are mainly of the profile and compressibility varieties. It becomes reasonable, therefore, to consider the other extreme, where, using a much-reduced diameter, a smaller quantity of air is dealt with and given a greater acceleration, thereby increasing the jet losses but reducing profile and compressibility losses.

The ducted-fan system of propulsion, as we understand it to-day, consists of a fairly large diameter ducted fan or axial compressor of relatively low compression ratio at the intake to the nacelle. Only a small portion of its delivery air is taken by the turbine, the remainder being by-passed directly to the jet. This system appears to have two main advantages:—

(a) A slightly higher envelope efficiency than both airscrew and jet systems over a relatively small intermediate speed range.

(b) It embraces the possibility of burning fuel freely in the air by-passed from the turbine, and thus increasing fairly considerably the power available for short periods, although at an enormous cost in consumption.

However, the drawbacks of the system seem to outweigh these two rather meagre advantages. The main disadvantage is the size of fan and of ducts required to deal with the relatively large volume of air required. This would appear to complicate aircraft application by reason of the large bulk to be disposed, which might so increase the drag as to nullify any efficiency increase over the normal propulsive system when considering the performance of the aircraft as a whole. There would appear to be no great problems to be overcome from the designer's point of view; sufficient work has been carried out on similar axial-flow fan installations in the past, for various applications, to give confidence in approaching such designs in the future.

"HANDS OFF" HELICOPTER

(*Concluded from page* 605)

using the United Helicopter factory only for final assembly, and by taking drastic steps in order to achieve rugged simplicity, Stanley Hiller has been able to put this machine on the U.S. market for $20,000 (a little over £7,000), offering a disposable load of 875 lb. One feels that the Model 360 would pass British A.R.B. requirements, although they are in certain ways stricter than those for America's C.A.A. approval. It would in any case be interesting to see if this is true; and if the Hiller were demonstrated to, and subsequently tested by, British experts, I have no doubt that very soon we would be forced to accept the fact that inherently stable helicopters are possible. This in turn would bring the realization that, if we wish to maintain our chances of having a place in the world market, we must adopt similar methods of stabilization to British designs.

[A photograph of a Hiller 360 helicopter making a 25-mile pilotless flight with its crew clinging outside the cabin appeared on page 578 of last week's issue.—ED.]

ANOTHER NEW CLUB

CLOSELY following a recent announcement in *Flight* that some courageous enthusiasts in Boston, Lincs, had opened a flying club, in spite of the discouragements at present afflicting private flying, comes news from Speke that a new club has been opened there. To be known as the Liverpool Flying Club, it celebrated its official opening last Saturday, November 5th, with a fly-past by the three Austers which form the club fleet and by two privately owned Consuls; there followed a cocktail party in the club-house, when the president declared the club well and truly inaugurated. G/C. Caistor, Speke's commandant, said that he was delighted to welcome the newcomers to the airport as there was nothing which would please the airfield staff more than a little gentle airborne relaxation in their off-duty hours.

Mr. G. A. Ford has been appointed manager, C.F.I. and secretary of the club for Wright Aviation, Ltd. The membership fees for full flying members are three guineas subscription with one guinea entrance fee, and, for non-flying members, one guinea subscription and one guinea entrance fee. Flying rates are £2 10s per hour for both dual or solo.

SEA HAWK

Hawker N.7/46 : Design Appraisal of Britain's Latest Naval Jet Fighter

BOTH as a science and as an industry aviation is still youthful, yet in the few decades of its existence there has been time for the establishment of various traditions. In spite of the threadbare shibboleth of equality which prevails to-day, and which makes it fashionable to deprecate all that is implicit in tradition, we in Great Britain are seemingly a little too closely bound up with a history of liberal civilization to do this quite successfully. Perhaps it is that in the course of the centuries we have learned that, no matter whether the tradition be one of faith, lineage or of working practice, it is something which in the furtherance of our daily lives has a very real value.

The prerequisite of tradition is, of course, continuity, and it is in their continuity of design practice and production that Hawker Aircraft, Ltd., have a unique record among the pioneer manufacturers of British aircraft. Founded as the Sopwith Aviation Co., the firm was established in Canbury Park Road, Kingston-upon-Thames, in 1911, and the original premises are still in use to-day—as a toolroom. Then again, since 1926, when an order was received for 48 Horsleys, the company has always had aircraft in production; certainly there have been lean periods and what are to-day called recessions, but never once in the past 23 years has there been an actual break in the production of Hawker aircraft. The tradition of the company has lain almost uniformly in fighter and light-bomber aircraft and it is, therefore, perhaps only natural that the current examples of this famous line should be in the van of their kind in performance.

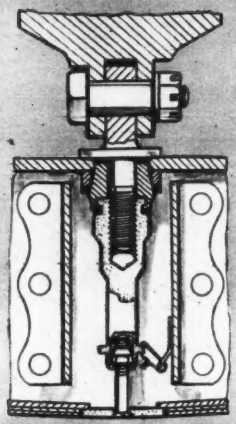
Before starting a detailed examination of the Sea Hawk, it is well worth while pausing to consider the background of the aircraft as a concept, and in order to do this it is necessary to go back some years, for it is lamentably true that the initial project design was finally crystallized as long ago as the end of 1944. We use the word "lamentably" with due consideration, since doubts on the part of people who should have known better, vacillation in high places and a plethora of red herrings made their several unfortunate contributions to a delay which amounted in the end to a full twelve months. It should be stated here that at this stage in its life, the aircraft was known by the Hawker designation P.1040. Then, in December, 1945, the Navy invited a tender for the aircraft as a naval interceptor; this was submitted in January, 1946, as a result of which an order was placed a month later for three prototypes plus one structural test aircraft. It was at this point that the specification number N.7/46 was initiated.

To go back for a moment to 1944: when the Hawker team, headed by Sidney Camm, first started seriously to consider the design of a turbojet fighter, they began, sensibly enough, with the power unit: the Rolls-Royce Nene. Its double-sided centrifugal compressor demanded an intake flow radially inward from a plenum chamber surrounding the whole compressor casing. It seemed logical, therefore, so to arrange the entrained flow that it swept through 90 deg direct to both sides of the compressor. The intake could have been arranged in a variety of ways—nostrils, elephant's ears or leading-edge mouths—but in the light of experience derived from leading-edge wing-root intakes on the Tempest, it was decided to employ entries of this type.

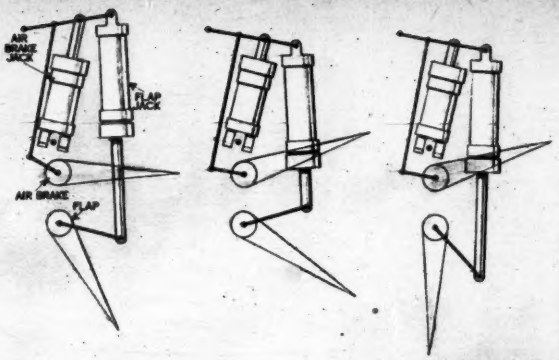
This in turn raised the matter of root thickness, but it was reasoned that if the thickness were maintained throughout the chord the jet pipes could be branched and readily faired. The drag of so relatively thick a section—roughly 13 per cent—would be effectively reduced by the very fact of having a flow through the core. In this connection, it is of interest to record that the root drag is somewhat less than that of the 9.5 per cent wing section proper.

By the employment of such a breathing arrangement, it was realized that other advantages were offered. In the matter of tankage, ready means were provided for the installation of large-capacity fuel tanks fore-and-aft of the engine and, therefore, symmetrical about the centre of gravity; at the same time, the conical form of the engine made available space in the under-flanks of the fuselage which was a godsend for undercarriage stowage. Still further, and not inconsiderably, the use of a bifurcated jet-pipe meant that a rear fuselage and empennage structure of conventional form could be used. Thus the nucleus of a fighter design was evolved.

Sea Hawk pilots will have the advantage of being fur-



Detail of single eyebolt engine-mounting point.



Jack movements for flap and air brake operation.

SEA HAWK . . .

nished with a dimensionally generous control compartment of admirably neat design. The Martin-Baker ejector seat is set on an upward sloping floor so that the parallel-action foot-adjustable rudder pedals are only slightly below the pilot's hip level; a bent-knee sitting position is, of course, of some help in combating the effects of *g*. Whilst at the moment a pole-type control column is fitted, it is possible that the thigh valances on the seat will make it necessary to employ a wrist-action stick, so that full lateral control is not hindered by the inability of the pilot to spread his knees; alternatively, swing-away seat valances would equally meet the requirement.

The instrument facia is arranged in three vertical panels, the blind-flying instruments being grouped in the centre (with the central instruments dropped a few inches to avoid masking by the gun sight). The side panels are raked rearward about 15 deg relative to the central panel, but although relief from parallax is given in the horizontal plane, the pilot's mean line of sight to the centre of the panel is of the order of 30 deg below the horizontal. On each side of the cockpit are control trays, that to port carrying the high-pressure and low-pressure fuel cocks, elevator trim-wheel, throttle, flap controls and undercarriage controls; whilst on the starboard tray are arranged the wing-folding control, the array of engine and electrical switches and the arrester-hook control. Radio switches and controls are arranged beneath the starboard rail of the hood. This latter is a Triplex unit of blown Perspex and is electrically operated from a control beneath the port rail. The hood is of particularly neat design in that no external rails are used; the rear supports are internal, and the side rails have roller trolleys moved by an endless chain running over sprockets at each end of a motor-driven cross-shaft behind the pilot's bulkhead. In addition to the ordinary electrical operation, the hood can be opened manually both from the interior and exterior, and is also provided with means of emergency jettison.

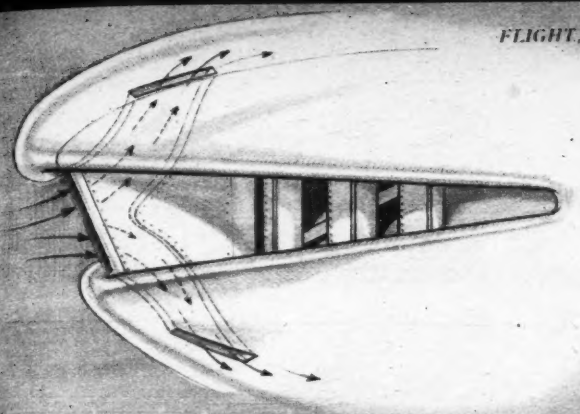
Aft of the pilot's seat is a bulkhead which forms the forward wall of the front tank-cell and on each side of the tankage accommodation in the flanks of the fuselage is mounted a pair of 20 mm cannon, for which Martin-Baker flat feeds are arranged. The bulkhead dividing the front tank-cell from the engine compartment is also used as a distribution member for the vertical loads imposed on the accelerator hook, which is pinned to a massive box fabrication at the transition between the keel members of the front- and centre-portions of the fuselage. The hook is spring-loaded for self-retraction and the main fore/aft reactions are, of course, taken in the keel.

Detail of Nene with "trouser-leg" jet-pipes, and showing engine-mounting steady-bracing.

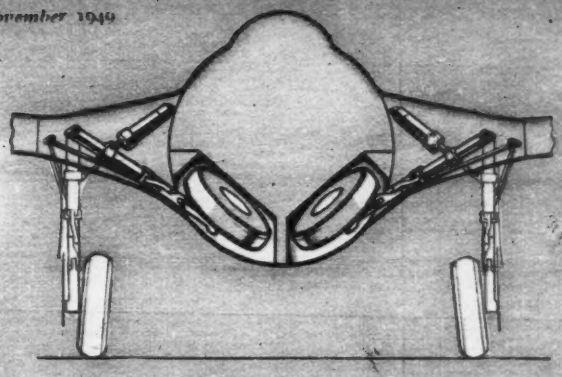
Neatness and purity of line are, perhaps, the chief characteristics of the Sea Hawk as a design; aesthetically, it is a very beautiful aircraft indeed and aerodynamically is remarkably clean, the only protuberances being a whip aerial, the pitot pressure head and the pilot's hood. This quality has been attained only at the expense of considerable design ingenuity in making use of almost every cubic inch of space; the manner in which stowage volume has been schemed out is extremely clever, and the fact that penalties have not had to be paid in accessibility for maintenance enhances the value enormously. The maximum diameter of the Nene is 49.5in, and some measure of the quality of fuselage "tailoring" is given by the fact that the maximum diameter of the fuselage is 58in (this being approximately at the main spar station). It is also of interest that, from the main spar forward, the fuselage cross-section is uniformly circular and of a progressively diminishing radius, whilst from the main spar rearward the section changes progressively to an ellipse which remains symmetrical although the major/minor axis ratio increases.

The method of mounting the Nene is delightfully simple in that it devolves essentially on a single point supplemented by triangulated steady-bracing. About 25in forward of the main spar is a robust semi-circular built-up box-beam which, following the sectional contour of the fuselage, at the base intersection with the fuselage keel forms the engine bearing point. A fork on the bottom of the compressor casing is pin-jointed to the lug of an eyebolt which depends vertically through the lateral beam and keel intersection. Beneath the stainless-steel plates of beam and keel is embodied a taper-bored steel block through which the shank of the eyebolt registers; a truncated cone plug is screwed up into the block taper by a nut on the eyebolt, so drawing the shouldered head of the bolt rigidly down on to the steel bed-plates. Access is obtained through a small hole in the fuselage skin which is filled by a tampion screwed into the heel of the eyebolt nut. Thus the power unit is supported at a single point—an arrangement which is possible only because the mounting-point is almost directly beneath the c.g. of the unit.

Steady-bracing is derived from a double triangulation of steel tubes picking up at three points on the crown casing of the compressor and pin-jointed at machined fittings on the front face of the main spar bulkhead. During removal or installation of an engine, these latter attachment fittings serve the extremely useful function of pivotal points whereby the unit (with the steady-bracing acting as radius struts) can be swung upwards and out of the airframe or, conversely, be swung downwards and inwards into its normal position. In order to render this possible,



Detail of wing-root intake, showing boundary-layer bleed.



Disposition of undercarriage, spread and retracted.

it is patently necessary that the upper portion of the fuselage between the main spar and the rear bulkhead of the front tank-cell should be formed as access doors.

At the forward lip of the front intake grill on the compressor casing is a diaphragm spanning the whole of the fuselage interior and forming the front wall of the plenum chamber. On the front face of this diaphragm are mounted two Graviner anti-fire system extinguisher bottles of 12-lb capacity which deliver through spray rings surrounding the engine. The rear wall of the plenum chamber is in the form of a truncated cone running from the web diaphragm of the main spar back to the turbine shroud-ring. Where the cone meets the latter is a narrow annular diaphragm, ventilated with metering holes, whereby a fixed amount of the plenum-air volume can leak rearward and escape to atmosphere past the jet-pipe shrouding in order to act as an insulating airflow. The "trouser-leg" jet-pipes are engine parts in that they were developed and are supplied by Rolls-Royce, and are fabricated in stainless steel and lagged with a cavity shrouding filled with aluminium foil. At the junction between turbine-shroud and jet-pipe trunk a special form of annular joint is used whereby a measure of universal movement is permitted, axial movement of the pipes due to thermal expansion being accommodated by hinged brackets in the outlet shroud throats.

Between the jet-pipes in the rearward portion of the centre fuselage is the main rear tank-cell. The fuel tanks are flexible-bag-type crash-proof units by Marston Excelsior, and the fuel supply system is arranged for the ultimate in convenience. Both front and rear tanks are provided with electrical booster pumps incorporating negative-*g* valves, and balanced flow-delivery is achieved by regulating the output of the booster pumps at the bidding of the fuel-content gauges. By this means, the rate of fuel abstraction from the tanks is automatically governed so as to maintain the optimum distribution of fuel load relative to c.g. position.

In the forward portion of the rear fuselage, stowage for radio equipment is provided on thwartships racks, disposed about a central location for the vertical camera. Immediately behind these is the emplacement for the oblique camera which is so arranged as to enable the camera to be trained either to port or starboard. The rear fuselage structure is a monocoque of Z-frames which are notched for the 2-section stringers. The base fin is integral with the fuselage up to the tailplane and incorporates machined extruded booms to the frames; at the head of each boom is bolted a machined fork-fitting to which complementary lug-fittings on the tailplane are pin-jointed.

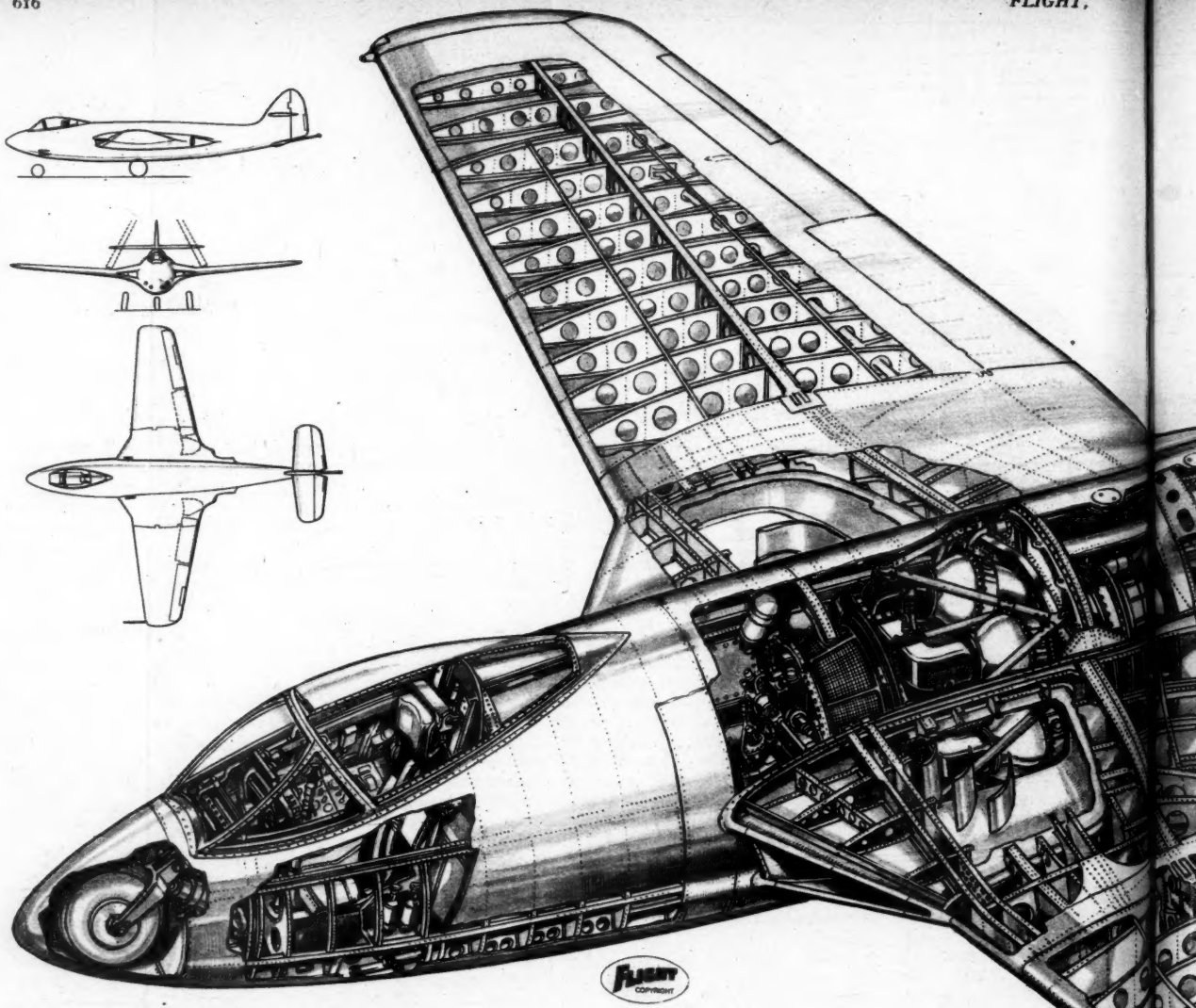
An unusual structural form is used for the tailplane in that four spars are employed; the foremost of these is a short-span unit taking drag loads, whilst the remaining three full-span spars take bending loads. All the spars have plate webs furnished with extruded angle-booms, and pressed-sheet inter-spar chordal ribs distribute skin loads. The upper-fin attachment-fittings are fork-blocks through-bolted in doubled vertical ribs.

Two self-aligning ball-bearing hinges are used for suspension of the rudder, the nose of which is shrouded by extensions of the fin skin aft of the fin post. From the D-nose spar, the 24-gauge rudder-skin is carried on pressed-sheet chordal ribs and 2-section stringers. A spring tab, the torsion bar of which stands vertically inside the rudder spar, extends from elevator level down to the turn of the rudder heel (although, at the present time, this is not used, the tab being fixed for permanent bias), and approximately 12in above the elevator is embodied a nose and mass balance with a lateral area of the order of 40 sq in. Whilst mentioning tabs it is opportune to record that, although spring tabs are fitted on ailerons and (nominally) on the rudder, the elevator is furnished only with a conventional trimming tab.

To form a recess for the lengthy strut of the arrester hook, the base line of the fin and rudder is relieved.

Some idea of the generous flap area so useful on a naval aircraft is given by this photograph. The air-brake surface is also shown.

With wings folded, the Sea Hawk's span is but 13ft 3in, so that internal stacking in even light fleet carriers should offer no problems.



In these special *Flight* drawings are shown the essentials of the design theme upon which the Sea Hawk has been conceived. The bifurcation both of the air inlets and the jet outlet has alone made possible the symmetrical distribution of fuel load.

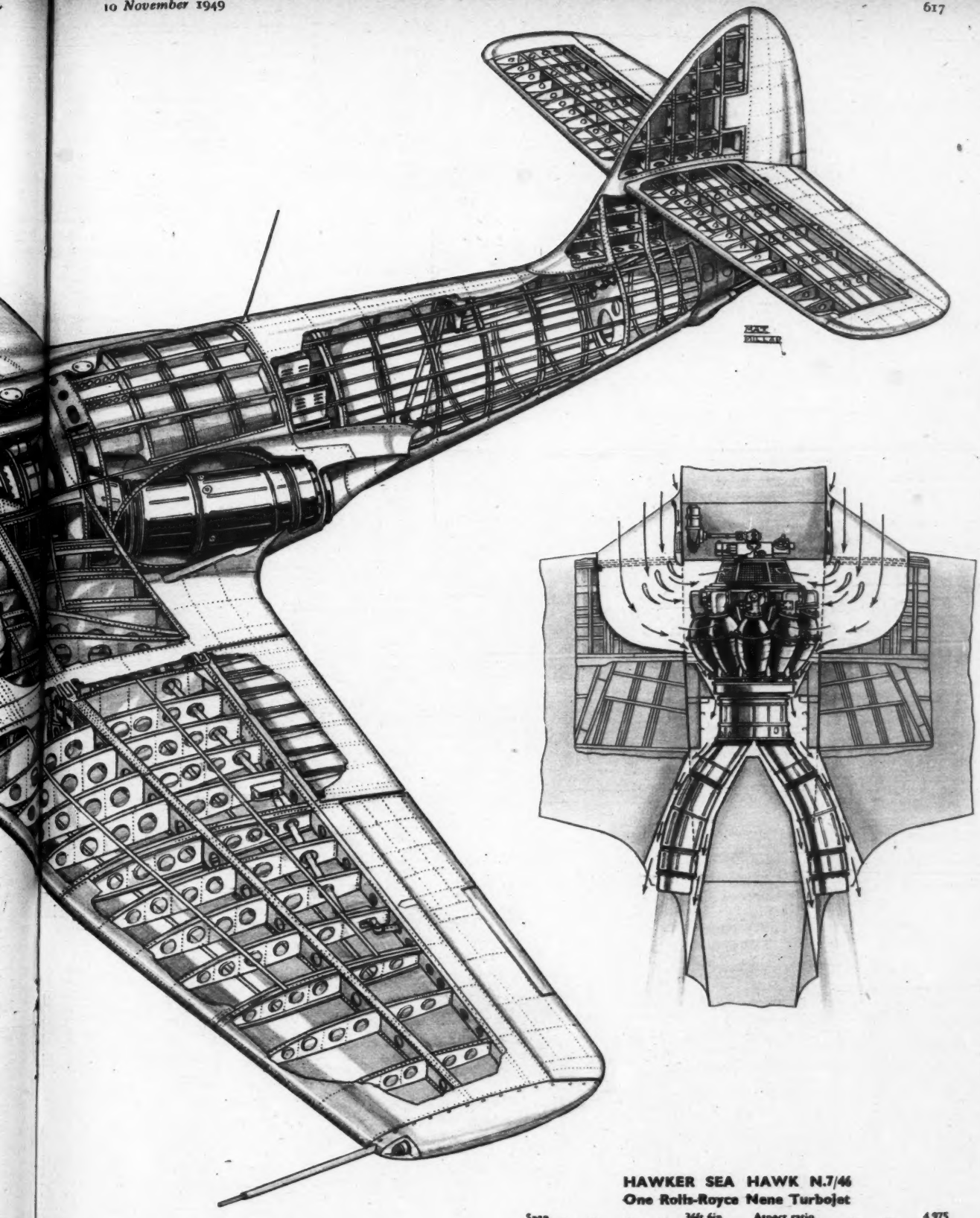
SEA HAWK . . .

Hook loads are distributed through a pair of horizontal diaphragms running forward approximately 3ft and with their flanges riveted to the fuselage/fin skin; the hook attachment fittings also pick up to the base of the second fin/tailplane spar-frame. In order to give some indication to the Deck Landing Control Officer during night flying, the head of the hook strut embodies a faired light-fitting. The elevator is built up with a wedge-section nose spar, pressed-sheet chordal-ribs and 2-section stringers, and is made in port and starboard halves joined by a bridging torque tube off which is a horn lever for control transmission attachment. A cantilever inertia-mass projecting forward into the fin is incorporated in the linkage so that in the no-load static-case the elevator is in the up position.

Before going on to deal with the wing proper—in which no ancillary components are embodied—the stub wings must be considered, and these are effectively an integral part of the centre fuselage. Between the wing-fold joint, both the main- and rear-spars are continuous structures, the diaphragm webs of which are expanded centrally to conform with the full diameter of the circular-section fuselage. Extruded and machined angle-section booms are carried continuously across the spar diaphragms, and although the main-spar is a straight unit perpendicular to the fuselage axis, the rear-spar bends forward outboard of the fuselage to conform with the trailing-edge taper of the wing.

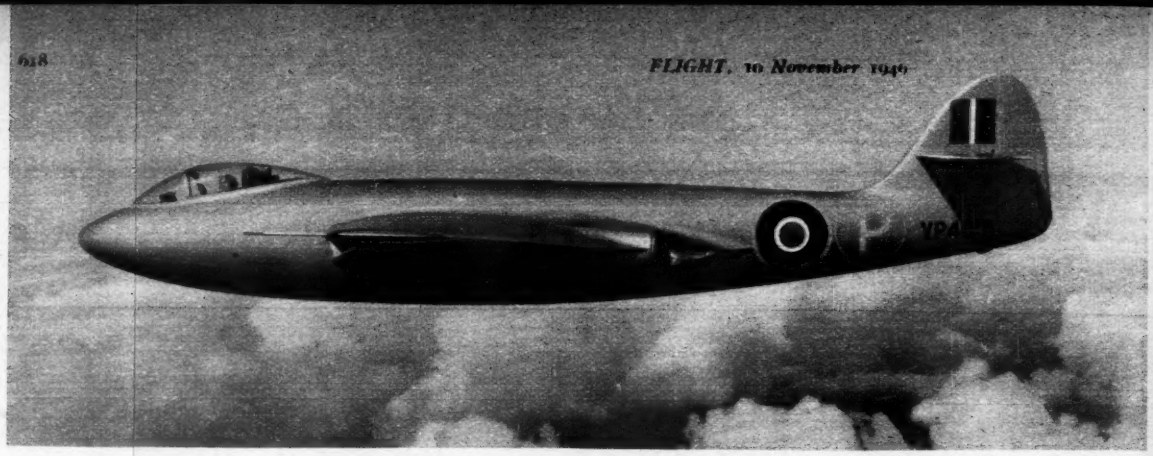
Forward of the main-spar in the wing-root is the air intake to the plenum chamber, the airflow being swept through 90 deg in four passages divided by curved guide vanes at the "elbow." Between the intake volume and the fuselage skin is a narrow slot through which the lower-velocity air of the boundary layer is scooped and exhausted back to atmosphere via exit slots in the upper and lower leading-edge root-surfaces: by this means, the entrained air to the turbine is kept largely free from the losses occasioned by boundary turbulence and drag.

Between the main- and rear-spars in the stub wings port and starboard, and disposed at an angle of about 20 deg, is a pair of diaphragm ribs with extruded booms, and between the forward ends of these ribs are bolted a pair of bearing blocks for attachment of the main undercarriage leg, whilst at the rearward ends of the ribs is pivoted the crown of the undercarriage radius-strut. Perpendicular to these is a further pair of diaphragms running inboard to the fuselage and between which the leg lies when retracted. The undercarriage actuating jack is anchored across the upper inboard ends of the diaphragms next the fuselage



HAWKER SEA HAWK N.7/46
One Rolls-Royce Nene Turbojet

Span	36ft 6in	Aspect ratio	4.975
Span, wings folded	13ft 3in	Standard mean chord ...	7ft 4.3in
Length, actual	39ft 7in	T/C. ratio	9.5 *per cent*
Height, wings folded ...	15ft 9in	Dihedral	4 deg 30 min
Height, wings spread ...	10ft 6.1in	Incidence	0 deg 30 min
Wheelbase	12ft 8.5in	Tailplane span	12ft 1.5in
Track	8ft 4.8in	Tailplane and elevator area, gross	39.75 sq ft
Wing area, gross	268 sq ft	Fin and rudder area, gross...	33 sq ft



That this latest naval fighter has one of the most beautiful fuselage shapes ever created will be universally agreed.

SEA HAWK . . .

skin. The truncated cone form of the Nene offers a useful void outside the plenum chamber in the flanks of the fuselage for stowage of the main wheels which, incidentally, are Dunlop units equipped with the latest form of plate-type brake.

The outboard ends of the main spar-booms carry long-tanged forged and machined double-fork fittings of high-tensile steel for engagement with the complementary fittings on the inboard ends of the outer-wing spar-booms. On the rear spar, there is a single-lug high-tensile steel fitting pin-jointed to a fork fitting on the mating outer spar. The hinge pins are respectively 1¼in diameter (front) and ¾in diameter (rear) high-tensile steel ground rods. The latch mechanism is simply a withdrawable pin uniting the doubled forks on the bottom booms of the main-spars, the latch pin sliding in a fore/aft-mounted guide under the actuation of a hydraulic jack mounted between a pair of chordal diaphragms immediately inboard of the stub-wing end-rib. The wing-folding jack is carried with a universally pivoted anchorage in a pair of hefty brackets bolted on the face of the main-spar in each stub-wing.

The stub-wings are skinned on a gridwork of top-hat-section stabilizing strips, intercostal to the spars; forward of the main-spar, however, the intake throats necessitate the use of chordal ribs having what can only be likened to a "lobster-claw" profile. Aft of the rear-spar, the skin is supported on pressed-sheet ribs with 2-section intercostal stringers. Skin gauges are 18 gauge for the top surface and 20 gauge for the lower surface, with 22 gauge skinning to the intake throats; between the spars on the top surface of the wing the skin is of 16 gauge—the complementary under-surface is mostly undercarriage door.

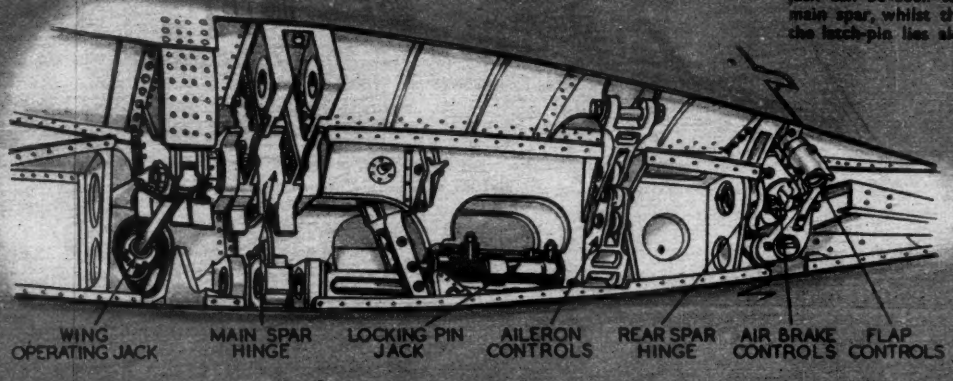
There are two outer and two inner flaps on the stub-wings, all joined by a continuous universally jointed system of spanwise torque tubes actuated, port and starboard, by a pair of hydraulic jacks mounted in the stub-wings and supplied from a common source.

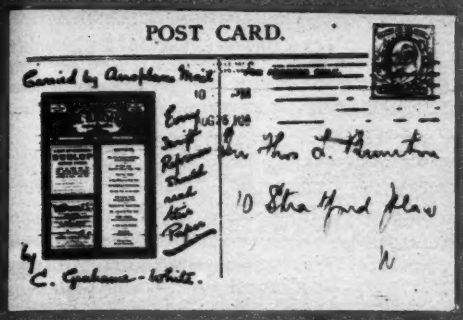
On the outer wing panels, the split flaps are commonly arranged in conjunction with hinged upper-surfaces for use as air brakes, drive being provided by extension torque tubes off the stub-wing system. Two jacks, port and starboard, carried behind the stub-wing rear-spar, are employed for flap and air brake actuation, the geometry of the linkage being such that (i) the flaps can be actuated alone by the flap jack, whilst the air brake jack is locked in the extended position. For air brake operation (ii), both jacks act in concert to raise the upper surface and lower the under surface (flap) to effect a balanced air-braking drag. For air brake and total flap operation (iii), the action is as for (ii) plus further extension of the flap jack fully to lower the flap surfaces proper.

Just forward of the main-spar in the under surface of the stub-wings are dive brakes of about 26in span by 8in chord, each being actuated by a small jack anchored at the head on the forward face of the main-spar web. Like the flaps, the dive brakes are interconnected by universally jointed torque tubes across the fuselage.

The 9.5 per cent t/c outer wing panels are built around a main-spar which is basically of channel-section, although the inboard ends are furnished with π-section machined steel-fittings for the wing joint. These fittings are, in fact, integral with the spar booms but run outboard only about 3ft where the spar changes to a heavy-gauge pressed-channel unit of which the gauge diminishes with span. The rear-spar is a pressed-channel single-piece unit out to mid-aileron span, thence being of lighter gauge out to the tip. Chordal-ribs are pressed-sheet units except where the skin gauge changes, at which stations the ribs are furnished with extruded T-booms. Skin thicknesses are 10 gauge from hinge to flap/aileron joint; 12 gauge to mid-aileron span; and 14 gauge to the tip. The upper skin is a single-piece from the leading-edge nose to the rear-spar, whilst the lower skin is arranged in two panels, i.e., from the leading-edge nose to the main-spar, and from the latter to the rear-spar; the leading-edge joint is made with an internal butt-strap. The quality of skin panelling in the lighter gauges used on the fuselage and tail surfaces merits praise, for the standard is high. C. B. B-W.

Detail of wing-fold joint. The main jack can be seen to the left of the main spar, whilst the jack actuating the latch-pin lies along the end-rib.





(Left) "The world's first aeroplane mail"—a relic of one of the flights of the pioneer pilot Grahame-White. (Right) Letter sent by experimental rocket mail on the Isle of Harris, Hebrides, in 1934. It was damaged when the rocket exploded.

PHILATELIST'S AIRMAIL

Historical Stamps and Covers that have Interested Collectors

By L. N. and M. WILLIAMS

One of the "unofficial" stamps used in the early days of Britain's internal airmail services.

IT is more than seventy years since the first stamp was issued especially for use on mail carried by air. It was not an official issue, but was made privately by Samuel Archer King, an early balloonist, who carried letters and cards on his balloon *The Buffalo* during a series of flights in the United States of America about 1877.

The stamp was printed in blue, was sold at 5 cents and showed a picture of *The Buffalo* floating in the clouds. Specimens have become rare, and as much as £90 was paid for a pair which came up for auction in London some years ago. Two or three pieces of mail which were carried by the balloon are still in existence, and bear not only the special stamp but also ordinary issues of the United States, affixed when the mail was recovered after being dropped from the balloon.

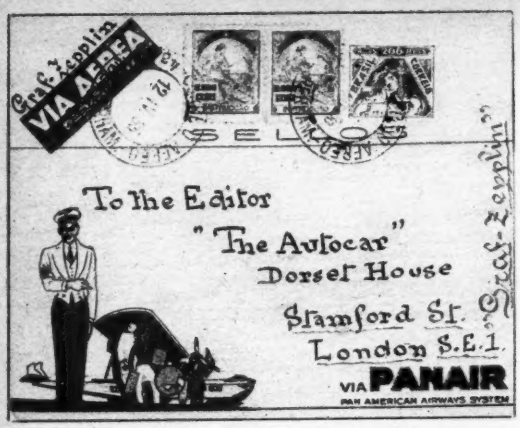
The first official air stamp did not come until forty years later, in 1917, when Italy overprinted her 25 centesimi "express" stamp with a special inscription for use on letters carried experimentally by air between Turin and Rome. Only short notice was given to the public that this flight was to take place, and the stamps were issued on May 16th; the flight was to have been made three days later, but bad weather led to its postponement until May 22nd. The return trip, from Rome to Turin, was made on the 27th. About 200,000 of the stamps were issued, and they are still easily obtainable to-day.

The next month a seaplane flight between Naples and Palermo was organized, and another special overprint was applied to an "express" stamp. Then, the following year, came airmail issues by Austria, Hungary and the United States of America. The Austrian and Hungarian stamps were used on letters carried by military aircraft flying from Vienna, via Budapest and Krakow, to Lemberg during the last stages of the Great War.

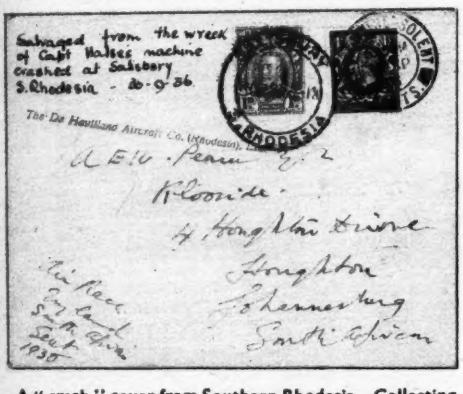
The American issue is particularly interesting. The design shows a mailplane in flight, and there were three values in the set, 6, 16 and 24 cents, the highest of which appeared on May 14th for the opening of a new service between Washington, New York and Philadelphia. A stockbroker's clerk at Washington, on going into a post office on the first day the stamps were issued, was fortunate enough to be able to buy an entire sheet of 100 of the 24 cents with the centres printed upside-down, so that the aircraft seemed to be flying on its back. This misprint, which had somehow escaped the examiners in the printing

Cover carried on Imperial Airways' first experimental airmail flight from Australia to England in 1931.

PHILATELIST'S AIRMAIL . . .



A *Graf Zeppelin* cover from Brazil.



A "crash" cover from Southern Rhodesia. Collecting relics of this kind is an interesting, if grim, sideline.

Qantas Empire Airways and Imperial Airways flew the cover below in their first service between Australia and England, in 1934.

(Below) Cover carried by the DC.2 piloted by Parmentier and Moll in the London-Melbourne air race, 1934.

works, eventually enriched the clerk by some £3,000, for he sold the sheet at a substantial profit.

The era of pioneer transatlantic flights saw the appearance of a number of interesting stamps for use on the limited amount of mail carried on the flights. The first was the "Hawker" issue of Newfoundland, made in 1919 for the unsuccessful attempt by Harry Hawker and K. Mackenzie Grieve. The then current 3 cents stamp, showing the head of a caribou, was overprinted "First Trans-Atlantic Air Post, April, 1919," and sold at 1 dollar. Only 200 specimens were overprinted, and 95 were used on letters. The Sopwith biplane was abandoned in mid-Atlantic when the crew were rescued by a Danish tramp steamer, but later was salvaged by an American ship and towed into Falmouth. Although the mailbag had suffered from immersion the letters were dried and delivered. The "Hawker" is one of the world's rarest airmail stamps, and unused examples are worth £400 or more.

Another early issue by Newfoundland was a 1-dollar overprint for the flight by Alcock and Brown. Specimens are much easier to obtain than those of the Hawker issue, and fetch only a few pounds each, but envelopes carried by the Vickers-Vimy on this pioneer Atlantic crossing are not very plentiful. The flights by de Pinedo, *Miss Columbia*, the DoX and General Balbo were all made the occasions of special issues of stamps, the first two being rarities.

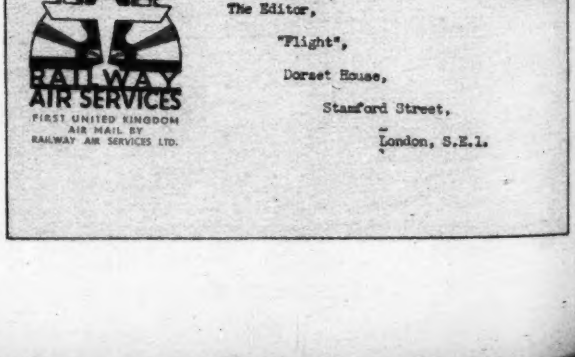
Great Britain has never officially issued special stamps for airmail, although the 6d stamps imprinted on air letter forms can, in a way, be considered airmail issues. The attitude of the postal authorities towards air stamps is that they are unnecessary, and that ordinary issues can be used equally well on all mail. Nevertheless, unofficial air stamps have appeared from time to time, the first being the green label produced for the Sinclair Tobacco Co. and used on parcels carried by B. C. Hucks during a flying week at Gosforth in February, 1913.

Twenty years later, in 1933, there was a crop of semi-official issues by the Great Western Railway, Provincial Airways, International Air Lines and others. The stamps were used on inland services, and are found on letters bearing ordinary British stamps which paid the postage from the airports to the addressees. Some covers carried on these services, especially first-flight covers, are quite rare, as only small numbers exist.

Semi-official air stamps have appeared elsewhere at different times. There were several issues in France and Switzerland shortly before the outbreak of war in 1914, and Germany also brought out a number of these stamps before and after that war. Canada, too, issued numerous stamps of the same kind between 1918 and 1929; they were used on mail carried by private aviation companies which ran services over the huge stretches making up the Dominion.

Apart from the actual airmail stamps the collection of covers can be interesting. Some of the early items are rare but can still be obtained at not too great an expense. A card carried on the first aeroplane mail flight, from Blackpool to Southport in 1910, might cost about £15, but a letter carried from Allahabad

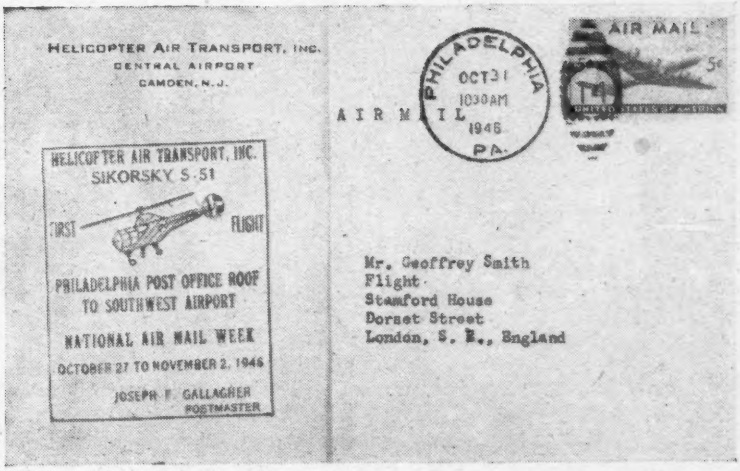
This cover was carried on the first flight by Railway Air Services from Glasgow to London in 1934.



PHILATELIST'S AIR MAIL . . .

to Naini Junction, on the first official flight, in February, 1911, could be bought for little more than £1. Pieces such as these would form a fitting introduction to an airmail collection, which could then be continued with more modern items.

It is true that in a number of cases the modern flown covers are of relatively less interest than those of the early days, because in most instances the letters were dispatched by air solely with the object of being carried on the flights concerned, but there is no denying that the envelopes or cards do provide a record of aviation and airmail progress which in itself is attractive and romantic. Even to-day it is possible, by carefully watching postal announcements, to secure further records of notable flights, so that a collection can be extended almost indefinitely.



A cover carried in the first helicopter mail, initially flown in a Sikorsky S-51 from the Philadelphia Post Office roof in October, 1946, to the city airport.

Most of the earlier covers usually bear cachets denoting the nature of the flights, and sometimes of a semi-pictorial character. Among the attractive cachets can be mentioned those used for the first Galway to London flight, the first regular transatlantic service in 1939, the first Australia-to-England airmail flight in 1931, and some of the *Graf Zeppelin* flights. In addition, special envelopes were issued, for example, by Imperial Airways for the initial flights between England and Australia, England and Africa, and England and South Africa.

During the McRobertson London to Melbourne air race in 1934 several of the competitors carried mail, quite a large number of letters being flown by the K.L.M. entry, the Douglas DC-2 piloted by Parmentier and Moll. Sometimes letters carried by aircraft which crash on land or sea are marked with evidence of the accident, and the collection of covers bearing witness to the occurrence is an interesting, if somewhat grim, sideline of air philately.

The days of romantic pioneer flights may be over, but an airmail collection can do much to recreate them in the mind of the collector.

BURMA STORY

"Wings of the Phœnix—The Official Story of the Air War in Burma." (Prepared by the Air Ministry and the Central Office of Information, and published by H.M. Stationery Office. Price 5s.)

TO date, the truest picture of the Burma air war has come in vignette form from writers of fiction, notably Nevil Shute and H. E. Bates, and from a very few observant combatants like Bernard Fergusson; now the whole huge canvas has been drawn in masterly outline by an official historian, who is understood to be W/C. Leslie Kark. His name deserves at least the honour of being printed in a book which is a model of clarity, atmosphere, impartiality, and—to this reviewer at any rate—commendable accuracy. The illustrations, too, are not the hackneyed material that sometimes fills the pages of official histories, and they feature the "erk" on the job rather than the high-ranking officer in conference.

It is, however, the author's balanced treatment which deserves the greatest praise. During the whole period covered —1941 to 1945—air power was manifested in an astonishing variety of ways by formations whose designation, direction, function and equipment were being constantly modified. Despite this, one feels that an American or Indian reader—or even a Japanese seeker after truth!—would consider that these 143 pages give his countrymen "honourable mention" where it is due.

One newspaper critic, ex-R.N., has deplored the absence of the Fleet Air Arm from the book, and, since the record rightly extends well beyond the frontiers of Burma itself, the rôle of carrier-borne aircraft (admittedly a minor one) might well have been discussed. Those who served in the R.A.F., or U.S.A.A.F., however, will surely feel that literary justice has at last been done to their efforts, and they will gain a new appreciation of the gigantic problems of strategy that faced the planning staffs.

The style of writing is flowing yet far from flowery, and even the better-documented episodes (the Chindits' glider descent on "Broadway," the final air assault on Mandalay, etc.) can be read as if for the first time.

Credit is given to many leaders, some of whose names are still prominent in the British aeronautical heirarchy—Coryton, Vincent, Williams, Mellersh among them—but these would be the first to insist on the truth that is so evident in this book: that the Burma war theatre called for, and extracted, exceptional individual morale and initiative. (Incidentally, one suspects that some of the commanders are given titles and/or ranks too early in the narrative.)

A man-made and far from glamorous "hero" stands out from these pages—the Dakota. The reader marvels again at the almost incredible volume and variety of work performed by this already veteran transport. A grand total of more than 550,000 tons of material lifted (by all supply squadrons) tells only part of the story. The anecdote which is printed of the British private who said: "They can keep their V.C.s and their M.C.s—give me the D.C.s!" may be apocryphal, but it is true to every Burma fighting man's affection towards, and trust in, a vehicle that literally kept him alive and, employed with imagination, finally turned the scale of battle.

G. D. H. L.

BRITAIN'S NEW BOMBERS

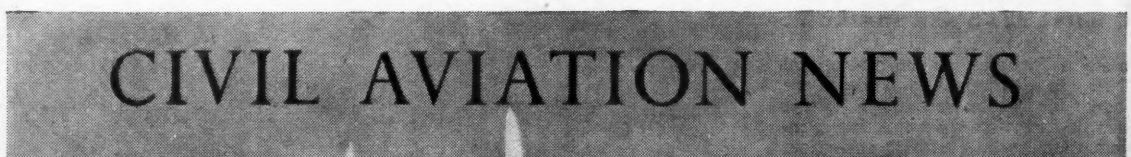
THE guests of honour at the third annual dinner of the Air Public Relations Association were Sir Roy Dobson, President of the S.B.A.C., and the Chief of the Air Staff, Lord Tedder, while Air Chief Marshal Sir Philip Joubert de la Ferté was in the chair.

Sir Roy, proposing the toast of the Royal Air Force, exhorted the Service to keep its powder dry: the powder in this instance was research and development. He twitted Lord Tedder on the subject of bombers, asking if the Royal Air Force intended to follow the lead given by the civil corporations in acquiring American aircraft.

Lord Tedder, replying, disclaimed all responsibility for the decisions which led to our bomber position being what it is, but he thought those decisions were right for the time at which they were made. He reminded Sir Roy that we already had at least one modern bomber on the stocks and that another was expected from the Avro stable.

Lord Tedder then went on to plead with his audience—which was composed almost entirely of newspaper men—not to put so much emphasis on the spectacular but to remember the many things happening each day, all over the world, which were being smoothly handled "by a few aircrew types."

CIVIL AVIATION NEWS



K.L.M.'S "CATS": Eighteen-passenger Catalina amphibians will shortly be operated by K.L.M on inter-island services in the Dutch East Indies. The photograph was taken at Atlanta, Georgia, where the conversions, which include the installation of more powerful Pratt and Whitney twin Wasps than those fitted in standard models, are being undertaken by the Aero Corporation.

RAPIDE REPLACEMENT

IT is reported that more than 16 designs for a small general-purpose transport aircraft to replace the obsolescent D.H. Rapide have been submitted for consideration by B.E.A.

B.E.A. has confirmed that if a satisfactory project is forthcoming an immediate order will be placed for 15 aircraft straight from the drawing board. As mentioned in *Flight* of August 11th, a cruising speed of 150 m.p.h. coupled with the Rapide's ability to operate from small and rough airfields are considered essential features of the new 10-15-seat airliner. As an effective means of reducing its operating deficit the Corporation hopes to use a replacement that will achieve an operating cost of 70 per cent of that of the Rapide.

B.E.A. utilize the Rapide on a 2,805-mile network of internal services in the U.K.

B.E.A.'s BRIGHTER OUTLOOK

FIRST results of B.E.A.'s economy programme reveal a substantial operating profit for the three-month period from July to September. This profit, which was calculated after all expenses had been paid, amounted to 6s 8d for each passenger carried, or a profit of £2 9s per flying hour compared with a loss of £10 per flying hour for the same period in 1948. Productivity increased to 2,983 capacity-ton-kilos per employee compared with the figure of 1,923 for the corresponding period of 1948—an achievement which was effected after a 14 per cent reduction in staff from 7,537 to 6,487 in 1949. An average of 3,202 passengers per day was carried—620 a day more than last year's figure.

The incentive provided by the Corporation's bonus scheme, which, it will be recalled, was the reason for a strike when introduced a year ago, is considered to have been largely responsible for the profit. Flying time is said to have increased by one-quarter, while only three-quarters of the manpower was used on aircraft maintenance as compared with the same period of last year.

COMPETITION IN AFRICA

UNCERTAINTY overhangs the inauguration of new services linking the Union of South Africa and Nairobi through Nyasaland. Both Central African Airways and B.O.A.C. have applied to the Central African Air Authority for permission to operate such services. Anticipating a favourable decision, B.O.A.C. proceeded several weeks ago with plans for the preparation of a flying-boat base at Cape Maclear, on Lake Nyasa, and announced (as mentioned in *Flight* of September 15th) that one of the three-times-weekly South African flying-boat services in each direction would night-stop at this base for a trial period of three months. The preparations, which included the transport of a 12-ton motor launch, the gazetting of Cape Maclear as a Customs Station and the establishment of extensive accommodation and refuelling arrangements, were of no avail, however, as the introduction of the service had to be postponed because the relevant operating licence had not been issued.

Meanwhile, Central African Airways have applied for a licence to divert their Viking service from Salisbury to Nairobi in order to call at Blantyre instead of at Ndola. Neither service can be put into operation until a decision has been made by the C.A.A.A., which has now announced that in view of the almost parallel routing of these services, the final consideration will be deferred to enable the two companies to consult each other.

LONG-RANGE FREIGHTERS

IT is indeed ironical that the opportunities which exist at the present time for greatly increasing the dollar-earning capacity of the British air freight market, as a result of devaluation, appear to be lost through lack of freighter aircraft possessing sufficient range and payload to make operation a paying proposition. This is a particularly regrettable state of affairs in view of the large cargoes which will tend to move towards America and Canada rather than in any other direction as a direct result of the new exchange rate. Of the aircraft which can make such trips, the few available Liberators can accomplish the flight only as far as Montreal, where, in the interests of economy, their cargoes must be transferred to regular airlines in order to complete the journey to New York. Converted Halifaxes and Haltons, too, can complete the flight only with a reduced payload and even would have to be routed by short stages via Iceland, Greenland and Newfoundland.

More suitable aircraft, such as Skymasters and Constellations, are, to a large extent, operated by state airlines which are not usually willing to make charter quotations lower than the normal airline rates, and, in any case, most airlines have not sufficient aircraft to undertake additional charter flights. Moreover, as European imports from North America are being progressively restricted to raw materials only, for which available payload is negligible and desired rates too low, return flights would quite often have to be made with an empty aircraft; high freight quotations would be necessary to cover this eventuality.

Business generally on the air-freight market is at a low ebb at the present time and there is reported to be a serious lack of forward bookings for the coming months. The position for Halifax and Halton operators has become particularly difficult and rates as low as 4s 6d per mile are currently being quoted in order to keep the aircraft flying in competition with Dakotas—aircraft which virtually captured the freight market

while the Halifaxes and Haltons were lucratively employed on the Berlin Air Lift. Lancastrian operators are also being represented on the Baltic Exchange but although their aircraft possess an even higher payload than does the Halifax, the stowage and loading facilities, like those of the Halifax, are unsuitable for most of the bulkier types of cargo. For such types there is thus a serious decline in freight rates, and during recent weeks there have been several unsuccessful attempts to sell Halifaxes, which, although obsolete, could not be immediately replaced by any aircraft offering the same payload.

An urgent need is apparent for a large-capacity, long-range freighter if Britain is to take full advantage of the dollar-earning potential of the air-freight market, and, while a distinct possibility exists for the employment of more Avro Tudor conversions in such a role, some doubt is felt as to whether any but the very largest of charter operators could afford the initial price or relatively high cost of maintenance which is likely to be demanded.

It might well be, however, that some measure of co-operation between the Ministry of Supply, the manufacturers and the potential operators might effectively reduce these costs to a figure which would place the Tudor within reach of the charter operators.

CARGO SPECIAL

A NEW freighter, developed by Douglas to fill a requirement for an all-cargo aircraft, was demonstrated recently in New York. The manufacturers claim that the DC-6A Liftmaster, as the new type is called, is capable of carrying a payload of 24,000 lb non-stop across the United States. Compared with the DC-4 it is said to be 40 per cent faster, 20 per cent cheaper per ton-mile, and capable of carrying 40 per cent more payload.

The Liftmaster has a maximum cruising speed of 320 m.p.h., and a payload up to 28,800 lb. Its cargo compartment, with a volume of 5,000 cu ft, has two main doors, one forward and one aft, both of which are hydraulically operated, and so placed that no point in the compartment is more than 20ft from either. Both doors are much larger than is usual, with the result that it is possible to stow packages nearly twice as bulky as those which can be carried in the DC-4. Cargo weighing up to two tons can be hauled aboard by means of a hoist which, built into the rear cargo door, folds inside when the door is closed.

A.O.A. IN 1949

AMERICAN Overseas Airlines report a profit of 727,000 dollars (£259,642) for the nine months ended September 30th, 1949. After deduction of taxes a net profit of $456,000 remains, a figure which compares with $447,000 for the same period last year. Operating revenue increased by more than $1,000,000 to $18,285,000 and the cost per revenue ton-mile was 46 cents for 1949 as against 55 cents in 1948.

This profit has been made despite training and other expenses incurred in placing Boeing Stratocruisers on the North Atlantic route, and the airline claims that economies resulting from this more modern equipment will not be fully reflected until next year.

The parent company, American Airlines, Inc., reports a net profit over the same period of $5,935,000 after deducting taxes, compared with a loss of more than $3,000,000 in the corresponding period in 1948.

B.O.A.C. REORGANIZATION

FACED with increased operating costs due to the higher price of petrol and maintenance of overseas stations occasioned by devaluation, B.O.A.C.'s resolute determination to reduce its annual operating deficit was evidenced by last week's announcement of a new system of administration, effective from November 1st. The new administrative pattern is designed to give practical effect to the advantages of the B.O.A.C. and B.S.A.A. merger and its implementation is consequent upon the deliveries of the Argonauts and Stratocruisers, the prospective introduction of the Hermes and the concentration of activities at London Airport.

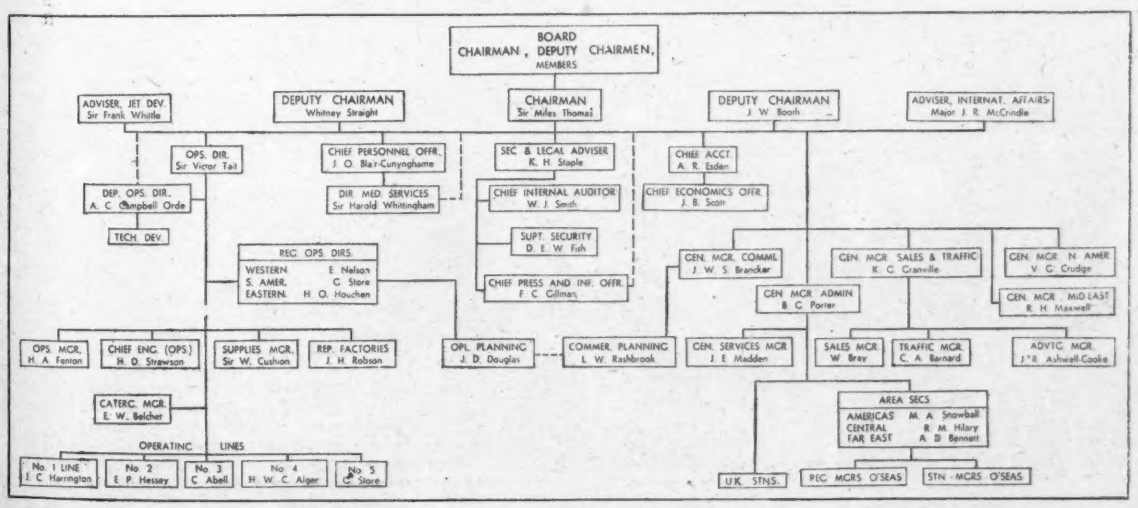
The former geographical division of the company into operating areas has been reorganized to provide a five-fleet system classified according to the various types of aircraft to be used by each Line. The five Lines, with their divisional headquarters, will be based as follows: No. 1 Line: headquarters at London Airport (Canadairs); No. 2 Line: Hurn, near Bournemouth, (B.O.A.C. Yorks and Lancastrians, plus Hermes when available); No. 3 Line: Filton, Bristol (Stratocruisers and Constellations); No. 4 Line: Hythe, near Southampton (flying boats); No. 5 Line: Langley, Slough (Yorks and Lancastrians taken over by B.O.A.C. when it absorbed B.S.A.A. in the spring).

Sir Miles Thomas, chairman of B.O.A.C., stated that "an economical and well-balanced structure is being achieved in the new pattern, and in the development of the organization at all levels the principle of clear-cut objectives and more precise definition of duties is being followed." Extensive economies in manpower are being effected and it is estimated that approximately 1,000 redundancies will result. Mr. R. D. Stewart, commercial manager of B.O.A.C., and Mr. F. N. Hillier, former publicity controller of B.S.A.A., are among 14 senior executives who are included in the list.

The resultant administrative system will be based broadly on the principle of raising the individual status of the operating-line managements and of decentralizing administrative control to selling areas and individual overseas stations. Executive control of operational and commercial activities is now placed directly in the hands of the two deputy chairmen, Mr. Whitney Straight and Mr. J. W. Booth. Sir Victor Tait becomes operations director and Mr. J. W. S. Brancker general manager for commercial activities. Mr. B. G. Porter will control administration of home and overseas stations, and a world-wide effort to stimulate sales will be the responsibility of Mr. Keith Granville, general manager for sales and traffic. The members of the new B.O.A.C. higher organization are detailed in the chart below.

Sir Miles Thomas added that the fundamental principles of the new pattern had been evolved in col-

B.O.A.C. HIGHER ORGANIZATION


BOARD
CHAIRMAN, DEPUTY CHAIRMEN, MEMBERS
ADVISER, JET DEV. Sir Frank Whittle
DEPUTY CHAIRMAN Whitney Straight
CHAIRMAN Sir Miles Thomas
DEPUTY CHAIRMAN J. W. Booth
ADVISER, INTERNAT. AFFAIRS Major J. R. McCrindle
OPS. DIR. Sir Victor Tait
CHIEF PERSONNEL OFFR. J. O. Blair-Cunynghame
SEC. & LEGAL ADVISER K. H. Staple
CHIEF ACCT. A. R. Esden
DEP. OPS. DIR. A. C. Campbell Orde
DIR. MED. SERVICES Sir Harold Whitingham
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CHIEF ECONOMICS OFFR. J. B. Scott
TECH. DEV.
SUPT. SECURITY D. E. W. Fish
REG. OPS. DIRS.
WESTERN E. Nelson
S. AMER. C. Store
EASTERN H. O. Houchen
CHIEF PRESS AND INF. OFFR. F. C. Gillman
GEN. MCR. COMML. J. W. S. Brancker
GEN. MCR. SALES & TRAFFIC K. C. Granville
GEN. MCR. N. AMER. V. G. Crudge
GEN. MCR. ADMIN. B. C. Porter
GEN. MCR. MID-EAST R. H. Maxwell
OPS. MCR. H. A. Fenton
CHIEF ENG. (OPS.) H. D. Strawson
SUPPLIES MCR. Sir W. Cushion
REP. FACTORIES J. H. Robson
OPL. PLANNING J. D. Douglas
COMMER. PLANNING L. W. Rashbrook
GEN. SERVICES MCR. J. E. Madden
SALES MCR. W. Bray
TRAFFIC MCR. C. A. Barnard
ADVTG. MCR. J. R. Ashwell-Cooke
CATERG. MCR. E. W. Belcher
AREA SECS
AMERICAS M. A. Snowball
CENTRAL R. M. Hilary
FAR EAST A. D. Bennett
OPERATING LINES
No. 1 LINE J. C. Harrington
No. 2 E. P. Hessey
No. 3 C. Abell
No. 4 H. W. C. Alger
No. 5 C. Store
U.K. STNS.
REG. MCRS. O'SEAS
STN. MCRS. O'SEAS

CIVIL AVIATION NEWS . . .

laboration with the Minister of Civil Aviation, and that its detailed implementation was the result of discussion between authoritative industrial consultants and the appropriate trade union consultative bodies. The chairman also expressed the opinion that the current year's results were not showing sufficient economies and that, although the staff reductions would be mitigated to some extent by the increased requirements of the forthcoming enlarged fleets, the cuts were being made in keeping with a policy which decreed "the industrial spirit of Britain to-day demanded efficiency above all else." This would appear to be a realization which, for the taxpayer, is heartening even if a little overdue.

AMERICA AND OUR JETS

SOME new sidelights on the concern with which America regards Britain's admitted lead in the development of jet airliners are revealed in somewhat patronizing opinions expressed by Capt. Eddie Rickenbacker, president of Eastern Air Lines, at a recent Aviation Writers' Association luncheon in New York. United States airlines would not buy British jet transports, he thought, because Britain would ask too high a price for them, and in any case would not attempt foreign sales until she had gained the advantage of using such types in operations herself. He also considered that the spare parts problem would be a great handicap. While admitting British ascendancy in jet-transport development, he was of the opinion that our lead was due to the financial aid given by the United States and also to the fact that American manufacturers had not, as yet, entered the field.

Capt. Rickenbacker did not think that too much time had been lost in "permitting" (our quotation marks) Britain to take this lead, since many problems had still to be solved before this type of equipment could be used commercially; he considered that jet transports would require a further five to seven years before they would be available for regular airline operations. (Could it be that news of the Comet's proving flights, which followed so soon after its maiden trip, had not yet reached America?)

The speaker advocated Government subsidies to assist in the development of jet transports and estimated that the cost of such development would be between 25 and 30 million dollars per aircraft—a venture which, he said, no U.S. airline or manufacturer was in a position to finance.

BREVITIES

ON October 26th S.A.S. inaugurated a new service, operated with DC-6s, between Stockholm and Bangkok, calling at Copenhagen, Zurich, Rome, Damascus, Karachi and Calcutta. The outward-bound service leaves Stockholm on alternate Wednesdays and reaches Bangkok on Fridays.

* * *

Records of Air France flying times for September reveal that Constellations flew 2,257 hours; DC-4s, 5,553; Languedocs, 2,959; DC-3s, 4,182; Ju 52s (Madagascar routes only), 429; Catalinas (West Indian routes only), 42; and Caudron 449 (for training purposes only), 64. Total time flown during the month was 15,486 hours, an increase of 33 per cent on the figure for September, 1948.

* * *

In a collision which occurred between an Eastern Air Lines DC-4 and a Lightning fighter flown by a Bolivian pilot near Washington Airport, all the occupants of the DC-4, numbering 55, lost their lives. A C.A.A. report indicates that the Lightning, which had been instructed to land after the DC-4 but did not acknowledge the message, collided with the airliner while the latter was on its final approach. The fighter pilot—variously reported to have been the Bolivian director-general of civil aviation and an official of the C.A.B. staff—was the only survivor. The accident is considered to have been the most serious in the history of American civil aviation.

* * *

The M.C.A. has now commenced its move to the new Ariel House building in Theobalds Road, London, W.C.1, and its address will be so designated when the move is completed within a few days. London headquarters staff will then be concentrated in three buildings instead of the present five, the offices at 19-29, Woburn Place being used to house the Establishments Division, the Directorate of Navigational Services and the Accidents Investigation Branch, and the Accounts, Supplies and Aeronautical Information Services being situated at Tolcarne Drive, Pinner.

* * *

In connection with B.O.A.C.'s contract with the Overseas Food Corporation, mentioned in these pages last week, the Corporation states that O.F.C. passengers will definitely be carried on scheduled Solent services and not by special charter flights; the regular four-a-week service to Nairobi will be used.

* * *

The amount of traffic handled by Mascot Airport, Sydney, for the three months ended September 30th shows that it has now superseded Essendon Airport, Melbourne, which was previously acknowledged to be Australia's busiest airport. During this period there were 5,356 scheduled movements at Mascot compared with 4,502 at Essendon.

* * *

Australian airline statistics for the year ended June 30th, 1949, although showing an overall increase in passengers carried and mileage flown, occasioned a slight reduction in load factor—66.1 per cent as compared with 66.5 per cent the previous year. Domestic airlines revealed an increase in passengers carried—from 1,217,178 to 1,438,396—and carriage of freight also improved by some 7,577 tons. Passenger mileage rose by 65,017,564 miles. Guinea Airways, with 76.6 per cent, continued to record the highest load factor.

* * *

The drafting of specifications for airfield approach and runway-lighting systems designed particularly to facilitate landings in adverse weather conditions is one of the main objectives of the fourth session of the I.C.A.O. Aerodromes, Air Routes and Ground Aids Division, now meeting in Montreal. Several different experimental systems are under consideration, and the subject of standardization of lighting arrangements for flying-boat bases is also being discussed.

* * *

As from November 7th the Ministry of Fuel and Power has authorized certain companies to supply fuel without coupons to some thirty named British and foreign airlines, to British charter aircraft and foreign aircraft for journeys to destina-

EVENING OFF: Members of the British Air Charter Association and their guests in the library of Londonderry House on the occasion of the Association's first dinner. Some sixty people were present.

tions outside Great Britain and Northern Ireland, and to aircraft coming into the country and calling at customs airports to enable them to complete their inward journeys. The authorization also allows aircraft which have landed at R.A.F. airfields to be refuelled by the R.A.F. without surrender of coupons. The companies authorized as suppliers are Airwork, Ltd.; Anglo-American Oil Co., Ltd.; Exeter Airport, Ltd.; Field Aircraft Services, Ltd.; the Newcastle Corporation; Shell-Mex and B.P., Ltd.; Skyways, Ltd.; and the Southend Corporation.

* * *

P.A.W.A. recently increased their flights between New York and Basra to three times weekly. The flights leave New York on Mondays, Thursdays and Saturdays, calling at Boston, Gander, Shannon, London, Brussels, Istanbul and Damascus. The 6,565-mile flight is said to take 38 hr 35 min.

* * *

A new service from Paris to Brazzaville in French Equatorial Africa was inaugurated by Air France on November 7th. The flight leaves Paris on Mondays, stopping at Algiers, Kano and Douala, and arrives at Brazzaville at 1505 hr on Tuesdays, just under 24 hours' elapsed time being necessary to complete the flight.

* * *

A new method of carrying radio-active isotopes in the wing-tips of transport aircraft has been reported from Johannesburg, where South African Airways are said to be modifying a number of their Skymasters to transport isotopes in this fashion. The heavy lead cases previously needed for insulation against radio-activity are thus dispensed with, and the resultant reduction in weight should permit a corresponding saving in cargo rates. This would make radio isotopes available to South African doctors at a fraction of their present cost.

FROM THE CLUBS

LAST year the Aero Club of Broken Hill, New South Wales, recorded 1,583 flying hours and in the first six months of this year 753 hours were flown. A comparison of expenditure per flying hour showed that in 1948 it was £4 11s 2d as against £4 2s 10d for the first six months of 1949. A Government subsidy of £2,223 was paid to the club, while three mining companies, North Broken Hill, Ltd., Zinc Corporation, Ltd., and New Broken Hill Consolidated, provided £2,033. The club's flying charges of 21s 6d for the first ten hours and then 31s 6d for each subsequent hour, are said to be the lowest in Australia. A profit of £267 was made by an aerial pageant held last Easter, and it has been decided to hold another next Easter. Of a total membership of 111, 18 pupils received flying training during 1948 and five gained "A" Licences.

* * *

BETWEEN now and February 28th, 1950, glider pilots all over the country will be competing in the Kemsley Flying Trust Winter Cross-country Competition, organized by the British Gliding Association. The Trust has once again donated the sum of one hundred guineas which, with the object of stimulating interest in gliding during the winter months and encouraging research into winter flying conditions, is to be awarded in the form of cash prizes.

In two classes, prizes will be given to the club or individual owning the gliders in which the winning flights are made. In the aero-tow launch class a first prize of 25 guineas and a second prize of 15 guineas will be awarded for the longest cross-country flight, and, in addition, ten guineas will be awarded to the club providing the first-prize winner's launch. In the second class, prizes of 25 and 15 guineas will be awarded for the two longest cross-country flights in sailplanes launched by winch, auto-tow or "bungey." Ten guineas will also be awarded to the club providing the launch for the successful contestants.

The contest is open to pilots of "C" Certificate category and above and is limited to flights commencing in the British Isles. Details are available from the secretary of the British Gliding Association at Londonderry House, 19, Park Lane, London, W.1.

U.L.A.A. ACTIVITIES

FOR some time past the Ultra-Light Aircraft Association has been investigating the possibility of fulfilling the need, long-felt in the ultra-light field, for a two-seater trainer. As a result of questionnaires circulated to members, the Association's design sub-committee has been able to publish a preliminary "ideal" specification. Desirable characteristics specified are safety, cheapness of initial cost and operation, simplicity of construction and ease of maintenance. Other considerations should be ease of flying and suitability for training, together with robustness and long life; good take-off and climb performance; and facility of housing, ground handling and transport. Comfort, range and speed are considered to be the least important attributes.

GOING PLACES: Mr. and Mrs. W. P. Bowles, who keep their Messenger at Denham airfield, within five minutes of their home, are able to make full use of it for business and social journeys.

According to the specification, the ideal aircraft would be a tractor monoplane with a cantilever low wing fitted with either split or plain flaps; the span to be from 30 to 35ft and the wing area 135 to 150 sq ft. A desirable all-up weight is considered to be 1,130-1,200 lb. Side-by-side seating in an open cockpit (or possibly one with a removable or sliding hood) is preferred, and dual should be provided by means of duplicated control sticks and rudder pedals. The undercarriage should be of non-retractable, tail-down-landing design and provided with a brake similar to that of the Fairey Junior. The airframe structure would need to be of simple wooden construction with ply and fabric covering. A flat-four cylinder engine of 50-60 b.h.p. is preferable, to be started by airscrew swinging.

Only a minimum of instruments, for visual flying, is considered necessary, although provision should be made for fitting a turn-and-bank indicator and a variometer. A fire extinguisher is considered essential. The aircraft should be stressed for the full range of aerobatics. Retail price should not exceed £550 and the aircraft should be supplied in parts for home construction.

Desired performance figures are given as: Stalling speed with flaps down, 37-40 m.p.h. cruising speed, 85-90 m.p.h.; maximum speed, 100 m.p.h.; take-off run in still air, 100-150 yd; initial rate of climb, 500-600 ft/min; range in still air, 250-300 miles; endurance, 3-3½ hr.

The U.L.A.A. experimental group at Elstree appointed Miss Jean Bird as C.F.I. at the end of August and dual instruction is being given on an Autocrat at £1 13s per hour. The Association's Zaunkönig is being operated by the group, whose total membership is now 36.

Following the loss of its Avro Tutor in July the Doncaster group curtailed flying until it acquired a B.A. Swallow, which was flown for the first time at the Skegness Rally on September 11th.

The Community Flying Club has now settled down at Aldermaston and in the first nine weeks of its occupation 110 hours were flown with the Piper Cub, including two first solos. At a recent annual general meeting Mr. A. J. Plummer was elected chairman of the Club and Mr. P. Meiklem became the secretary.

FIELD SERVICE

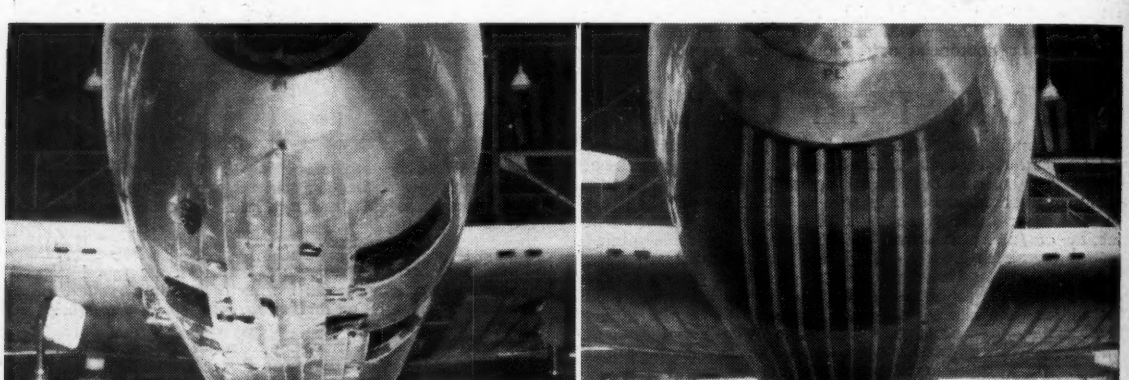
"Jury Rig" Brings a Damaged Viking Home for Repair

AN unusual and enterprising repair job was recently undertaken following a wheels-up landing in France. A British-based aircraft was involved, and in such instances there are usually obvious reasons for doing as much of the repair work as possible at home and for avoiding dismantling or land transportation of units. In the case in question, which occurred at the end of August, the pilot of a B.E.A. Viking, G-AHPL, was faced with the necessity to make a belly landing at Le Bourget. After having used up his excess fuel, he achieved his object without injury to passengers or damage to freight or luggage, although the aircraft swung off the emergency landing strip, slid across the runway and continued over the runway boundary line. The Viking was subsequently removed to an Air France hangar for complete inspection.

Damage to the underside of the aircraft was severe and extended for 50ft along the fuselage from near the nose to within 6ft of the tailwheel. All the frames and stringers in the area were damaged, including the main leading-edge and trailing-edge frames. The forward cargo hold doors were badly buckled, as was the freight floor. Both airscrews were extensively damaged, and the oil cooler shrouds were badly buckled. Incidentally, the undercarriage had failed to operate because, it is stated, the jack attachment had come adrift from the cross-tube.

The chief engineer and chief inspector of Field Aircraft Services, Ltd., to whom the task was given, carried out a survey and decided that a temporary repair was possible to enable the aircraft to be flown back to this country for final repairs. A working party of four men and one supervisor was detailed for the job, which entailed restoring all the frames by fitting spruce blocks to the damaged portions of the fuselage and then by plating the underside with 16-gauge dural sheet secured to the sound portion of the fuselage and attached to the spruce blocks by wood screws. Compression strength normally provided by the internal structure of the fuselage was restored by fitting eight channel-section members from the front end of the aircraft to the undamaged portion at the rear. Steel girders were attached above the freight floor across the leading-edge and trailing-edge frames, and wooden blocks attached to these beams were wedged between them and the floor to restore rigidity.

This temporary repair was carried out in eight working days, during which time two new airscrews and two new oil coolers and a new starboard retraction jack were also fitted. The Viking was then flown without incident from Le Bourget to Tollerton airfield, near Nottingham, where the final repairs were carried out at Field's airframe-servicing base. The photographs below give an impression of the magnitude of the job.



BEFORE AND AFTER: The underside of the Viking's fuselage in its damaged state and (right) with the eight reinforcing members and temporary skin fitted. The damage originally looked considerably worse, for these photographs were taken, in the reverse order, when the Viking arrived at Tollerton and the temporary work was stripped.

TO CIRRUS MAJOR OPERATORS

BLACKBURN AND GENERAL AIRCRAFT, Ltd., have issued a Cirrus engine service instruction stating that it has come to their notice that a number of Cirrus Majors may have incorrect taper on the crankshaft.

The airscrew hub GB.2320, says the instruction, is designed to seat firmly on the large diameter of the crankshaft taper but it is possible that on a number of engines the hub may be seating harder on the small diameter. This may cause severe fretting to take place, and if it is not corrected there is a possibility that considerable damage may result.

The Air Registration Board has instructed that the following examination shall be made as soon as convenient but not later than November 30th, 1949:—

(1) Remove propeller and hub (see Instruction Manual, Section 4, page 7, Fig. 30, and Section 5, page 1).

(2) Remove countersunk screw and key from hub.

(3) Carefully clean the tapered portion of the crankshaft and the interior of the hub and apply a thin coating of engineers' marking blue to the hub taper.

(4) Replace the hub firmly on the crankshaft taper, rotate sufficiently to obtain a marking, and remove.

(5) If the marking obtained shows that the hub is seating harder on the large than on the small end of the crankshaft taper the hub may be refitted. An entry should then be made in the engine log book certifying that the crankshaft taper has been inspected in accordance with Service Instruction G.4 and found satisfactory.

(6) If the marking obtained at (4) indicates that the hub is seating harder on the small than on the large end of the taper the aircraft should not be flown pending corrective action and the matter should be reported to the Engine Service Department, Blackburn and General Aircraft, Ltd., Brough, E. Yorks, when full instructions will be issued.

ALAN SUTCLIFFE

FLIGHT learns with regret of the death, on Friday, November 4th, of Alan Sutcliffe, D.F.M., a test pilot of D. Napier and Son, Ltd., as the result of an accident to the Tempest on which he was making a routine test flight. Mr. Sutcliffe had been flying for Napiers since June, 1946, before which he spent two years as a Service test pilot in the Engine Research Flight of the R.A.E., Farnborough. During the course of a distinguished R.A.F. career he was awarded the D.F.M. as a bomber pilot. He completed tours with No. 85 Squadron (Mosquito night fighters) and with a fighter interception unit where he was engaged on operational testing of new airborne radar.

A colleague writes: Test pilots of the calibre of Alan Sutcliffe are rare, and his loss will be felt acutely by his company and by the industry as a whole. Those who knew him will have lost a staunch companion and loyal friend. The sympathy of everybody will go to his parents and his five-year-old son, Grahame.

CORRESPONDENCE

The Editor of "Flight" does not hold himself responsible for the views expressed by correspondents in these columns. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

AIRMET

REFERRING to Mr. Church's letter in *Flight* of October 13th it would be useless to deny that the Airmet broadcast is technically below the standard of perfection to which we are accustomed in B.B.C. broadcasts. It would, indeed, be surprising if broadcasts made by meteorological staff as part of the day's work in an improvised studio closely adjacent to noisy technical installations could rival the best efforts of the B.B.C. I can assure Mr. Church that those responsible for the broadcasts are fully conscious of these imperfections and will remedy them just as quickly as limitations of staff, accommodation and equipment will allow.

Your columns are not, perhaps, the best arena in which to discuss the musical merits of the interval signal. I very much doubt, however, whether listeners would acclaim the idea of playing the opening bars of "Auld Lang Syne" over and over again, as suggested by Mr. Church. The present trumpet theme has at least some relevance to "Airmet," and after hearing it once no listener could possibly fail to recognize it again. That, after all, is the principal merit which any interval signal should possess, especially in the case of a broadcast which listeners on airfields and elsewhere want to tune in as quickly as possible.

E. B. BILHAM,
Deputy Director,
Meteorological Office.

Dunstable, Beds.

THE STRIDENT HARVARD

IN your editorial "The Noise about Noise," published in *Flight* dated October 27th, you quote Grantham as an example of a town which had to put up with Harvards for several years during the war. According to my log-book R.A.F. Grantham first received Harvards early in 1939 and they were all allotted away before war was declared. So Grantham Town only had to put up with them for approximately seven months.

When the Harvards first began to fly at Grantham the pilots were not used to the constant-speed airscrew. Because there were many night workers who had to sleep in the daytime in the town the "Harvard noise" raised a storm of protest which, I think, eventually reached the House of Commons. I believe the many protests resulted in the Harvards being replaced by quieter aircraft, although seven months elapsed before the replacement was effected.

My real purpose in writing this letter is not to quibble with your facts, but to mention an incident concerning the noise of aircraft which occurred whilst the Harvards were at Grantham. After they had been operating for about three or four months, when there were many more than at the beginning, when the protests were loudest, and when night flying with Harvards was in full swing, I was asked by the Mayor of Grantham what had happened to all the Harvards! I was somewhat astonished that the people of Grantham had apparently got used to the noise so quickly; but it was too late; the wheels had been set in motion and we unfortunately lost our Harvards.

R. F. F.

Beds.

INSTRUMENTAL PROGRESS

THE article "Flying to the Limits" in *Flight* of October 27th proved very interesting reading; but may we, as one of the leading aircraft-instrument manufacturers, take exception to the statement: "Quite obviously, until instrument development catches up with fighter performance . . ."

It is true that present-day fighters and fighter-trainers are still fitted with instruments similar to those used at the end of the war, but this, as regards gyro instruments at least, is not because development has lagged behind requirements. At approximately the same time as the first practical jet-propelled aircraft—the Gloster E28/39—was undergoing its initial flights, the Sperry Gyroscope Company was testing a new compass—the Gyrosyn—and an electrically operated gyro-horizon, both designed to meet future operational requirements of such aircraft.

Continued liaison with the Admiralty, Air Ministry, Royal Aircraft Establishment and the Ministry of Supply was necessary to make certain we were developing what was actually required, and the usual procedure of service trials following prototype trials was followed. This entails a long development period but it does ensure that only the most suitable instruments are accepted for use by the Royal Navy and Royal Air Force, and they are well tried before going into general use.

We would not wish present and future pilots of the R.A.F. to feel that instruments still have to be developed for their aircraft, and so hasten to assure them that gyro-magnetic compasses and electric gyro-horizons (topple-free) designed by us have passed service trials and are now in production. We believe the same is also true of the electric turn and bank indicator manufactured by Pullins, so Service pilots can look forward to flying with gyro instruments designed to meet operational requirements of the new fighter and bomber aircraft.

Our research and development group—which, incidentally, is by far the largest in the aircraft instrument field—includes a flight research department that flew over 1,500 hours in the last twelve months, and very much in their minds is the fighter pilot's problem so aptly put in your article ". . . 20,000 feet of cloud and ten minutes' kerosene between aircraft and runway." May we assure them that we are working hard to make life a little easier for them.

COLIN A. RICHARDSON,
Manager, Aeronautical Department,
The Sperry Gyroscope Co., Ltd.

Brentford, Middlesex.

GLIDER LAUNCHING

I HAVE only just seen a copy of *Flight* of October 27th containing a letter by Mr. Tilghman-Richards, in which he describes his 1912 method of launching gliders by means of a derrick, a heavy weight, and a deep hole. In the days when this method was evolved by the Wright brothers, suitable rubber rope was not available, but now that it is, the weight and derrick method can be forgotten, because of its lack of mobility, its complication and its expense.

I appreciate that by the weight method the launch can be made with only one person besides the pilot, but rigging and ground handling usually take more than this number. A bungey launch could be made by stretching and pegging the ends of the ropes separately, with no greater hazard of a premature start than is involved using the weight and derrick method. But as, in practice, a car is usually necessary either to take the glider to the top of the hill to begin with, or to retrieve it if it lands at the bottom, this car can be used to stretch the bungey if sufficient people for an ordinary bungey crew are not available.

The launching of gliders from hill-tops presents very little difficulty; there is, however, vast scope for improvement in the methods of launching them from flat sites. Under ordinary conditions a winch launch to 1,000ft can be made only from a field at least 3,000ft long. A launch to a height lower than 1,000ft makes it very much more difficult to catch thermals. But as 3,000ft fields are unnecessarily large for all aspects of gliding except the actual winch launch, an improved method whereby 1,000ft of height could be achieved from a shorter ground distance would allow gliding to be carried out from normal fields instead of from a large airfield.

ANN DOUGLAS.

Redhill, Surrey.

FORTHCOMING EVENTS

Nov. 15. R.Ae.S. Graduates: "Visualization of Airflow at High Speeds," by A. D. Young, A.F.R.Ae.S.
Nov. 16. R.Ae.S. (Brough): "Stiffness and Strength," by Prof. A. R. Collar, M.A., D.Sc., F.R.Ae.S.
Nov. 16. Royal United Service Institution: "The Services in the Far East," by Admiral Sir Denis Boyd, K.C.B., C.B.E., D.S.C.
Nov. 18. Institute of Navigation: "Navigation in High-Speed Flight," by W/C. E. Anderson.
Nov. 19. British Interplanetary Society; Symposium, "Medical Problems of Space Travel."
Nov. 19. Colleges of Automobile and Aeronautical Engineering: Annual Reunion Dinner.
Nov. 20. Society of Model Aeronautical Engineers: Annual General Meeting.
Nov. 22. R.Ae.S. Section Lecture: "Engine-driven Gearboxes," by G. W. Bubb, A.F.R.Ae.S.
Nov. 22. R.Ae.S. (Belfast): Lecturettes and Films.
Nov. 23. R.Ae.S. (Reading): "British Airships," by Lord Ventry.
Nov. 23. R.Ae.S. (Luton): Brains Trust.
Nov. 24 R.Ae.S.; "Aerodynamic Cleanness," by E. J. Richards, M.A., F.R.Ae.S. (at Bristol).
Nov. 26. Helicopter Association; "Aero-elastic problems of Rotary Systems," by Prof. A. R. Collar, M.A., D.Sc., F.R.Ae.S.
Nov. 29. Society of Instrument Technology: "Instrumentation on the Martin Open-hearth Furnace" by G. Husson and P. Rodicq.

LORD TEDDER on AIR DEFENCE

"We will Never Win a Match with Eleven Goalkeepers"

IN the Assembly Hall of the Royal Empire Society on November 3rd, Marshal of the Royal Air Force Lord Tedder, G.C.B., Chief of the Air Staff, spoke on "Air Defence." The Rt. Hon. Sir Archibald Sinclair, K.T., C.M.G., who presided, remarked in his introductory speech that in recent months our minds had been preoccupied by what Sir Stafford Cripps had well described as the problem of the economic survival of our nation. It was, however, well to be reminded that there was a cognate and urgent problem of our political survival—of the survival of our western civilization and of the ideals of freedom, justice, democracy and the rule of law. The foundations of our State, of our Commonwealth, and of any union of states for the defence of these ideals must be those of power. Innocence was no protection against an aggressor. Sir Archibald described Lord Tedder as a fighting airman; the type, or rather the exemplar, of the modern air force officer; a profound student of the art and principles of war, and a master of its rapidly developing technique.

War, said the C.A.S., was total, and everyone in the country had a share of responsibility. In this respect the country was very much like a boxer, for whom bulging biceps and knobbly knuckles were insufficient; he had to be fit all round, and first and foremost his morale must be good. Lord Tedder was sure that so far as the armed forces were concerned, good morale was accepted as the first principle governing their effectiveness, but he was not so sure whether it is always realized that the real key of the whole business was national morale. When we commemorated the Battle of Britain each year we quite rightly honoured the airmen who fought that battle over this country, the Channel, the North Sea and the Continent, but he had always felt that one factor no less vital to that victory than the skill and courage of the airmen was the unshakable morale and spirit of the people of the country. We were rather proud of talking about backs to the wall, thin red lines and last ditches, and we could be proud that the tougher things got the tougher we were. But in these days we could not afford to be complacent about that characteristic.

No Time to Get Frightened

During that frightful period so appropriately called "the phoney war" it was not infrequently said that until our nation was really frightened we could not get down to business properly, and if we were honest with ourselves we had to admit that there was an element of truth in that. In the last war we lost all the first rounds of the contest; in fact, we were unpleasantly close to being knocked out; but with modern developments in the technique of war we simply must realize that we could not afford to take that sort of chance again. As regards the last war, Providence was very kind to us. We were given considerable warning, and it was four years before the Battle of Britain that the expansion of the R.A.F. began. We had further warning and breathing space as a result of Munich, and then eight months or so of the "phoney war." Despite all that, we were overwhelmed in Norway, France, Greece and Crete. Those were the days when soldiers and sailors who had passed through hell in tragic campaigns came home with bitterness in their hearts and on their tongues against the Air Force. The Air Force had let them down, they felt; and yet those were also the days when many of our brightest and best gave their lives against hopeless odds in a gallant attempt to help our soldiers and sailors. Magnificent, but not war. We could only be thankful that there were enough left—a few—to hold the fort in the critical struggle of the Battle of Britain. Nothing could now carry on effectively on land or sea, whether military, naval or economic, without air superiority. Unless and until we had command in the air over our own country, or over our own forces, our Army and our Navy were virtually paralysed, and if we lost that command over our own country our whole economic and political life was in jeopardy. In the early days of the war, though we were superior, Lord Tedder thought, in quality of men, aircrew and aircraft, we had not the numbers required, and, moreover, we had no secure air bases.

Push-button warfare, as it was called, might come in some form or another, but not in the immediate future, and the principle which had been proved again and again in the last war was true now, and will remain true for years—that in war nothing on the surface of land or sea could operate effectively unless and until the situation in the air was under firm control. This was sometimes expressed by the saying that the air battle must first be won, but this was an over-simplification. The air battle was not a matter of hours, like a naval battle, or a matter of days, like a land battle: it was a fight which continued as long as the enemy had any striking force left. It was often thought that the Battle of Britain took place only in August and September, 1940. One phase of it did—the daylight phase over London and the rest of the country; but it continued at first at night over England, and then, gradually, as first Bomber Command by night, and later the American 8th Air Force by day, forced the fight across the Channel, across the Rhine until finally it was being fought out over the heart of Germany.

There were people who thought that air defence was simply a matter of fighters and anti-aircraft guns. Lord Tedder could not imagine any more dangerous fallacy. It might as well be said that because boxing was sometimes called the gentle art of self-defence all the boxer needed to do was to cover up. During the latter part of 1944 the Nazis had nearly a million people directly involved in operating their anti-aircraft guns, their searchlights, their radar, and fighter control, and at that time they were producing more fighters than the combined production of British and American aircraft and engine industry, which had to meet world-wide commitments. Yet at precisely that time the Allied Air Forces had almost complete air superiority over the whole of Germany! The Bomber Command attack on Peenemunde, where the V-bombs were being developed; the attacks on the V-1 sites in Northern France (which delayed the attack by three or four months); the attacks on transportation in North Europe and Western Germany, which completely disorganized the supply of V weapons and enormously reduced the scale of that attack—those were as much a part of the Battle of Britain as the fighter battles which weaved over the sky of London in September, 1940. Moreover, Lord Tedder had yet to hear of the fighter or the gun which could deal with the rocket. The bomber could, and did.

In these days equipment was becoming more and more expensive, and it was more and more difficult to provide and equip the forces which would be strong enough to gain time at the beginning of a war. In point of fact, without great care and discrimination it would be possible for a country so to spend its efforts on military establishments as to sap its economic health, and if it did that, what was the use of its military defence? Actually he did not believe that any single democratic country—even the United States—could or would pay for forces which, by themselves, in a single national sense, would suffice to gain time. He imagined that no one would contest the statement that the most immediate and the most dangerous threat would come from the air, and the trouble was that that threat could develop such a great intensity so rapidly. In the past the inevitable relative unpreparedness of the democratic nations had often proved to be an irresistible temptation to a would-be aggressor, and the potentialities of a sudden blow from the air were now so great that that temptation might be much greater—much less resistible—now than in the past.

Nobody Wins

On the other hand, said the C.A.S., there was ample evidence that a long war did not pay either victor or vanquished. In other words, while the possibilities of a short *blitzkrieg* were probably more tempting to an aggressor than ever before, the prospects of a long war were very definitely most unappetising, even to an aggressor. Therefore, if the free peoples could ensure that they were strong enough to gain the time and make it clear to the world that they could defend themselves effectively against that opening, critical, phase of the war, the risk of any aggressor attempting a *blitzkrieg* would be greatly reduced. Hence the association of peoples which is now being formed under the Atlantic Pact. The pooling of resources and the collective defence now being organized should provide a combined strength to deter aggression.

Lord Tedder had seen it suggested a number of times recently that in view of the fact that the U.S. had long-range bombers and at the moment the R.A.F. had not, it should be arranged that the R.A.F. should concentrate on what is called "air defence" (what he called "tactical air force"), leaving the role of strategic bombing to the U.S.A.F. He believed that people who made proposals of this sort had an erroneous idea that an "air defence" force was composed entirely of fighters, and a "tactical air force" of fighters and fighter-bombers. He pleaded guilty to having been largely responsible for

coining the phrases "strategic bombing" and "tactical bombing." In 1943 those terms were very valuable in defining the somewhat different roles but he was very much afraid that recently they had come to be misunderstood, and as a consequence, rather dangerously misused. "Strategic" to an army commander was "tactical" to an air force commander, and what was strategic to an air force commander was (with all respect to the C.A.S.'s military friends) very often completely outside the ken of an army commander, because it was not his job—it was "off his map." But it was strategic to the air commander. People who were talking on these lines of a "strategic" air force would say that in the last war Bomber Command and the 8th Air Force were "strategic," yet, as had been pointed out, Bomber Command played a vital and direct part in the air defence of this country right up to the end. Again, Bomber Command and the 8th Air Force made a number of attacks in close support of the land forces, and for many weeks were carrying out operations against enemy communications.

These mistaken attempts to draw hard and fast distinctions between strategic and tactical were not only unsound—they were really dangerous. If applied in this way such distinctions would destroy that flexibility of the Air Force which was one of its most valuable characteristics—that quality which made it possible to concentrate air power in a manner quite unattainable by any other force or any other weapon. The initial job of the R.A.F. as a whole at the outbreak of a war would be air defence, and bomber, fighter-bomber and fighter, each according to its own particular powers, would be directed towards the single aim of gaining air superiority and of pushing the air battle away from our skies.

Fighter, fighter-bomber and bomber were all complementary to each other. We would never win a match with eleven goalkeepers; so we must not forget that it was the bomber that would push the air battle back from our skies. The less one's own people, soldiers and sailors, saw of the air war, the better that war was going on. That was not understood at the beginning of the last war, in which the air situation was not safe until the air war had moved right away from our skies and the Battle of Britain had become the Battle of Berlin. In any possible future war more than ever would it be vital that that air battle should be pushed away from our skies.

In answer to a question on technical strength of the Air Force, Lord Tedder said that however much respect he had for the Americans, he personally would not be prepared to recommend that we should entirely rely on American skill, technique and science to produce the punch without which we were helpless. He thought that to put our punch into the hands of our best friends in the world would be wrong. It might not be logical but he thought it was sound common sense.

Sir Frederick Handley Page, who was called upon to address the assembly, described the aeroplane as one of the most marvellous symbols possible of the right way in which a nation should conduct its affairs. It had a left wing and a right wing, and it was an extraordinary thing that all the motivating power and the control was in the centre—in the fuselage.

Sir Robert Watson-Watt, who referred to himself as "a simpleton who led a band of inspired simpletons," was suspicious that his colleagues in the scientific and technical world, in so far as they were devoting themselves to military readiness, had perhaps forgotten to be simpletons. We had got to get the people in the Universities inspired by the knowledge that they must do something quite novel.

STATE COMPETITION

—*In Air Charter : Views of the B.A.C.A.*

THE Overseas Food Corporation's contracts recently lost by two independent operators to B.O.A.C. (referred to in last week's issue of *Flight*) form the subject of a statement published by the British Air Charter Association. Our own feelings on the subject were reflected in a leading article in the October 13th issue, and while *Flight* acknowledges B.O.A.C.'s right to submit quotations in the charter market if it wishes to do so, the position would appear to be that, under the terms of the Civil Aviation Act, the Airways Corporations are entitled to use their subsidies to enable them to compete with independent charter companies. The statement in another *Flight* leader (October 20th) to the effect that "there is no virtue in flying uneconomically loaded aircraft merely to increase the usably capacity load mileage" is reiterated for consideration in the light of this new development. The B.A.C.A. statement is appended verbatim in a slightly abbreviated form:—

"The recent reference in the National Press to Air Transport Contracts which have been lost to the British Overseas Airways Corporation by two of the independent air transport operators and the comments on the M.C.A. procedure which seems to have brought about this result, are causing the greatest concern to the independent operators. This matter calls for the fullest publicity because, on the face of it, it appears to be a deliberate attempt to harm the independent companies at any cost, and this cost comes from the pockets of the taxpayers.

"When aircraft were suddenly required for the 'milk run' to carry more than a million gallons of milk from Northern Ireland to England last year, only the independent companies could provide them. When the much more serious emergency of the Berlin Air Lift was thrust upon the nation, again, the civilian aircraft—which carried nearly 25 per cent of all the loads into Berlin transported by the combined R.A.F. and civil forces—were supplied, for the greatest part, by the independent companies. In other words, the independent companies were the real national reserve of aircraft and air crews. If these companies are forced out of existence the country will lose a valuable reserve of aircraft and trained crews and ground personnel. . . .

"The independent companies do not fear honest competition, but are they facing honest competition? When the Civil Aviation Bill was being debated in Committee, some very important statements were made, and answers were given by the Parliamentary Secretary; they are worth recalling. On May 21st, 1946, the Parliamentary Secretary said: 'When this Socialist Government came to formulate a policy for civil aviation, we thought we had done rather handsomely by private enterprise by debarring it only from the field of regular services and leaving it the aerial work and charter flying. Here we are concerned only with aerial work. The types of aerial work which chiefly concern us are aerial photography, aerial surveys, archæological services herring spotting, and any form of commercial or industrial flying not needed for air transport services. . . . I am prepared to give an assurance that the Corporations do not intend to go into this work in any big way. . . . It is not the intention of the Government to use extra subsidies for this purpose. . . .'

"On May 22nd, 1946, the Parliamentary Secretary said: 'It is necessary that the Corporations should have power to undertake charter services and that they should be free from all ambiguity. That is why we want these words in the Bill. There may be charter work which a private company would be unable to undertake. It may be of such scope that no private firm could undertake it. For such reasons, it is essential that the Corporations should be free of all doubt about their abilities to undertake this work, but, as in the case of aerial work, which we have previously discussed, it is not our policy that the Corporations should make charter work a main undertaking. Their main job is regular scheduled services, but we do not wish to debar the Corporations from accepting any requests for charter work which may be made to them, and there may be occasions when only the Corporations can undertake such work.'

"'Mr. Errol: Can the hon. Gentleman give us a specific example of such a case? It is entirely hypothetical, and it will be extremely difficult for us to reply.'

"'Parliamentary Secretary: There may be a demand for a very large aircraft to take a party to the Antipodes, which would not be in the power of a private company. . . . If they can do it, they will be able to do it, and we will put no hindrance in their way, but I have to look to the possibility that they may not be able to do it. Again, there may be people who, even if a private company could do it, would prefer to use the services of the Corporation. It is only permissive, and not an obligatory power, and I assure the Committee that there will not be restrictions on the operations of private companies.'"

After the above quotations, the B.A.C.A. statement continues: "This morning one reads that a thousand employees of the British Overseas Airways Corporation are to be dismissed; this is a sad and distressing announcement. If the independent companies had not been restricted for the past three years by the Civil Aviation Act, 1946, and if they had been able to build up their businesses freely, many of those who are now about to lose their jobs would probably have been absorbed by the independent companies. However, not only is this possibility now taken from them, but life is being made still more difficult for the independent companies, who themselves are finding it impossible, under the restrictions to which they are being subjected, to retain all of their present personnel. . . ."

NEW HOME FOR C.U.A.S.

Chief of Air Staff Speaks as a Cambridge Man

ON Sunday, November 6th, the new headquarters of the Cambridge University Air Squadron were officially opened by the Chief of the Air Staff, Marshal of the Royal Air Force Lord Tedder.

The squadron's first headquarters were built at Fen Causeway on land belonging to the Engineering School, which was let to the Air Ministry for a rental of £1 per annum, and here the squadron stayed for 23 years. After the war, however, the faculty required room to expand the Engineering School, and long notice was given to the squadron. This, in fact, was twice extended, but when the time came to vacate the headquarters, no alternative accommodation had been found, and from May, 1948, until September 20th this year, the Unit was lodged on No. 5 Reserve Centre at Cambridge Airport. The present headquarters property at No. 3, Chaucer Road, were bought at the beginning of this last summer term, but were in such a very poor state of repair that it has taken until the beginning of the present academic year to get the place in order. Squadron members have worked mightily at clearing and restoring the garden from the virtual jungle that it had become. Now, however, clean, new-painted, orderly and attractive, the headquarters are a fit establishment for the pioneer of the University Air Squadrons.

Lord Tedder spoke more as a Cambridge man than as the C.A.S. in his address, and recollected that it was almost exactly 40 years since he himself had come up as a freshman. He also remarked that being the first University Air Squadron in this country and, therefore, in the world, meant quite a bit. It was not for nothing that Cambridge had the reputation of leading the world not only in science, but in poetry; it was a peculiar combination, but there was a good deal of poetry in aviation as well as technology. Lord Tedder also mentioned, quietly and almost with sly humour, that of the five present members of the Air Council, two were Cambridge men: it was worth bearing in mind.

The Vice-Chancellor, in explaining why the opening ceremony had been delayed by 15 minutes, succeeded in making a happy allusion. He had been assisting at Great St. Mary's in the annual service of commemoration for the University benefactions through the centuries. Dr. Roberts told the assembly that he had himself lived some years ago in Chaucer Road, and could assure them that a very respectable road it was; he also remembered that, in 1940, he had assisted in digging a tank-trap across that very garden. He agreed wholeheartedly with Lord Tedder's remarks regarding the humanistic side of aviation, and joined the C.A.S. in wishing the establishment all prosperity and success.

Lord Tedder then presented the Forder Finlay Cup for the best all-round Class 1A cadet of the year to Cadet Pilot B. Plenderleith, and then presented the Squadron Shooting Cup to P/O. R. H. Walkington.

On behalf of the squadron, W/C. C. H. Simpson, the Commanding Officer, then thanked Lord Tedder and presented him and Lady Tedder with mementoes of the occasion.

NOCTURNAL CROP SPRAYING

FOR the first time, crop-spraying by night has been carried out by Pest Control, Ltd., in the Sudan. Against the bright starlit sky of the million-acre Cezira plain (writes a correspondent) the spraying helicopter appears in the distance as an even brighter and multi-coloured star. As it approaches one sees the silvery shape of the rotor disc, tinted by the red and green navigation lights (for even in that remote spot the law is observed), the spray-bar tip lights, and the landing lights—only one of which is used during spraying. Added to these is the blue flame of the exhaust, all reflected against the fuselage, with other reflections coming up from the sand when the machine flies low. The helicopter appears to be tailless, only the rotor and main fuselage being visible in the darkness.

On the ground the "flagmen" indicate the spray-path by torches, and beyond them are the lights of the tankers. Ten miles or more away across the vast flat plain can be seen the lights of tractor-drawn machines operating in other areas.

Night spraying is necessary because, in spite of a daybreak start with pre-dawn preparations, spraying time is limited to the cooler hours. Long before and after noon the air is too thin to enable the helicopter to carry a useful load. Spraying is resumed in the late afternoon and continues when night falls sharply at six, though not for many hours, since there is such a thing as pilot fatigue.

James Harper, A.F.C., Pest Control's chief pilot, prefers to do the job himself for the present. He makes vertical landings by the light of the tankers' headlights. These landings are a little tricky, for the sand throws up reflections which make height-judging difficult. Turns, which are done over the sand, take a little longer than by daylight. The result is that, instead of spraying 100 acres an hour as by day, only 60 acres an hour can be done at night, but it is nevertheless a valuable contribution to the total work to be done.

The crop being sprayed is cotton, and the insect being attacked is the cotton jassid, which is very prevalent this year owing to lack of rain. It succumbs to a D.D.T. spray.

The machine used is the Westland Sikorsky with Pratt and Whitney engine. The spray-bars, originally in front, have been moved aft, and the auxiliary engine to drive the spray pump is mounted under the nose.

GUILD CEREMONIAL

"FIight" photograph

The ceremony at Londonderry House on Friday last. Wardens and Assistants stand after the Master, W/C. Pike had been installed.

LONDONDERRY House was the scene of the annual Installation Ceremony of the Guild of Air Pilots and Air Navigators of the British Empire last Friday evening, November 4th. It was mainly a quite informal, domestic party, but appropriately there were a few serious minutes when everyone assembled in the library for the Ceremony of Installation of the Master, Wardens and Court of Assistants.

The Clerk called each by name, the Chaplain led prayers, then first the Master, W/C. C. A. Pike, A.F.C., and afterwards the wardens (Messrs. Cumming, Chichester, Jenkins, Stone and Tyson, together with Marshals of the Royal Air Force Sir John Salmond and Lord Newall) and Assistants of the Court, all made the promise. This impressive little ceremony was completed by the blessing from the Chaplain.

SERVICE AVIATION

METEOR BOMBER: Already recognized as a most effective interceptor, the standard Gloster Meteor 4 becomes a formidable ground attack aircraft when carrying two 1,000 lb bombs on external pylon-type mountings. These bombs, it will be noted, have shortened tail-fins.

Benevolent Fund Appointment

IT is announced that Marshal of the R.A.F. Lord Newall has accepted the vice-presidency of the R.A.F. Benevolent Fund, to which he has been elected by its council.

Two-way Records Confirmed

THE F.A.I. has confirmed the performance in a D.H. Hornet 3 on September 19th by G/C. A. C. P. Carver, who flew from Gibraltar to London at an average speed of 435.871 m.p.h., as an international point-to-point record for Great Britain. Also confirmed—as a British national point-to-point record—is F/L. H. Peebles' London-Gibraltar flight in a Mosquito, at 357.565 m.p.h., on September 15th.

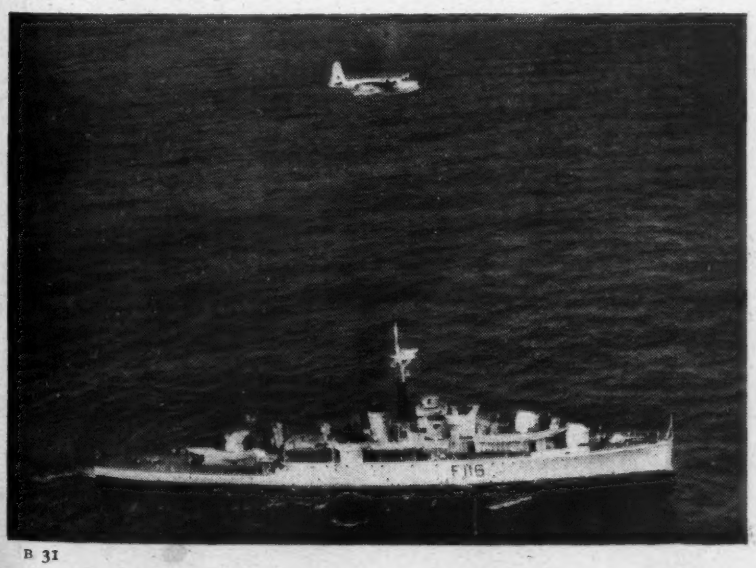
Royal Air Force and Naval Aviation News and Announcements

R.A.F. Appointments

THE Air Ministry announces that Air Marshal Sir Hugh Pughe Lloyd, K.B.E., C.B., M.C., D.F.C., is to become A.O.C.-in-C., Bomber Command, in February, 1950, in place of Air Marshal Sir Aubrey B. Ellwood, K.C.B., D.S.C. The latter is to be Deputy Chief of the Air Staff, in February, 1950, in place of Air Marshal Sir Hugh S. P. Walmsley, K.C.I.E., C.B., C.B.E., M.C., D.F.C. A.V-M. Francis Joseph Fogarty, C.B., D.F.C., A.F.C, succeeds Sir Hugh Lloyd later this month, with the acting rank of Air Marshal.

Sir Hugh P. Lloyd has commanded the Far East Air Force since November, 1947, and was formerly Senior R.A.F. Instructor at the Imperial Defence College for nearly two years. Previously he commanded "Tiger Force," which would have taken part in the air assault on Japan but for the Japanese surrender. From March, 1943, to November, 1944, he commanded the North-West African Coastal Air Force and while in that post organized the air escort operation covering the Salerno landings. Born in 1894, he served in the first World War as a private in the Royal Engineers from 1915 to 1917 and afterwards as an officer in the R.F.C., transferring to the R.A.F. in 1918.

Air Marshal Sir Aubrey Ellwood was appointed A.O.C.-in-C., Bomber Command, in October, 1947, after having been at the Air Ministry for two years as Director-General of Personnel (II). He was formerly S.A.S.O. at H.Q., Coastal Command, from March, 1944, and previously commanded No. 18 Group, Coastal Command. At the outbreak of the war he was an instructor at the R.A.F. Staff College. He is 52, and was commissioned in the R.N.A.S.



WELCOME HOME: Some 175 miles from Plymouth, H.M.S. *Amethyst* was met, appropriately, by two Sunderlands of No. 201 Squadron, Calshot. One of the aircraft carried G/C. Jefferson, Sig. I Morby and Gnr. II Devaney, all of whom were aboard the Sunderland which went to the assistance of the *Amethyst* during the Yangtse engagement.

The new E.T.P.S. badge has a particularly apt motto. (Left) Among those at the School's dinner, reported below, were Lt. Cdr. Smith, U.S.N., G/C. L. S. Snaith, receiving the armorial bearings from Air Marshal Sir Alec Coryton, and F/L. J. A. Rowland, R.A.A.F.

SERVICE AVIATION . . .

in 1916, receiving a permanent commission in the R.A.F. in 1919.

Until recently, A.V-M. Fogarty was S.A.S.O., Flying Training Command, an appointment he took up in June, 1947, after having been A.O.A., R.A.F. Mediterranean and Middle East Command (now Middle East Air Force), for a year. Formerly, he commanded Air H.Q., Italy, from November, 1945, and for nine months previously was Air Officer in charge of Administration, Mediterranean Allied Air Force. Born in 1899, A.V-M. Fogarty was commissioned in the R.F.C. in 1917 and transferred to the R.A.F. in 1918.

R.C.N. Winter Cruise

ACCOMPANIED by a destroyer and a frigate, the Canadian aircraft carrier *Magnificent* will leave Halifax on November 15th for a 21-day training cruise to the West Indies. The cruise is being preceded by a period of working-up trials for the ship and its Carrier Air Group—the 18th—which consists of Nos. 825 and 826 Squadrons, both equipped with Fireflies. During the summer, the Group spent two and a half months in America exercising with squadrons of the U.S. Navy. The *Magnificent*, a light fleet carrier, is commanded by Commodore K. F. Adams, the Senior Canadian Naval Officer Afloat, and Lt. Cdr. R. I. W. Goddard, D.S.C., commands the 18th C.A.G.

E.T.P.S. Dinner

TO mark successful conclusion of the second complete course to be held by the Empire Test Pilots' School since its move from Cranfield to Farnborough, the School's guest night was held on October 27th. Lord Tedder was the guest of honour, and among those present were Air Marshal Sir Alec Coryton, Mr. W. G. A. Perring, Director of the R.A.E., and representatives of the U.S. Air Force and Navy, the R.A.E. and Boscombe Down.

After dinner, Sir Alec Coryton presented the school with its armorial bearings, which were received by the Commandant, G/C. Snaith. In his speech, Lord Tedder stressed the test pilot's importance in the development of new aircraft and the necessity of his having a scientific background. He declared that, just as the Gosport system of flying training, developed by Col. Smith-Barry, revolutionized flying training, so the work of the E.T.P.S. was establishing a similar basis for test flying.

Photographs of the presentation ceremony, and of the E.T.P.S. badge, appear above.

Wakefield Competition Results

ROYAL Air Force Station Cranwell provided the winning team in the officers' championships of the 1949 Lord Wakefield Trophy boxing competition, which involved some 1,000 bouts at various R.A.F. home stations. The winning senior airmen's team represented Little Rissington, and the junior airmen's Calshot.

Runner-up for the officer's championship was Lyneham; North Luffenham and Little Rissington tied for third place. Runner-up and third-place winner in the senior airmen's class were Cosford and Cardington. In the junior airmen's class Upper Heyford took second place, with Waterbeach third. Finals of the officers' and senior airmen's classes were boxed at Cosford as they have been in the past; the finals of the junior airmen's class, however, were staged for the first time at Padgate.

The three trophies, one for each class, were presented to the R.A.F. Boxing Association in 1919 by Lord Wakefield, to promote team spirit and encourage all Air Force members to take an active interest in boxing. Competition is limited to novices who have never won a boxing championship.

At Cosford the officers' and senior airmen's trophies were presented to the winning teams, as were medals to the individual winners and runners-up, by Air Marshal Sir John Whitworth Jones, A.O.C.-in-C., Technical Training Command. A. Cdre. H. L. Patch, Chairman of the R.A.F. Boxing Association, and commanding officer of R.A.F. Station, Boscombe Down, Wilts, presented the trophy and medals to the junior airmen's class winners.

Honorary Appointments

IT is announced that his Royal Highness the Duke of Gloucester has consented to become Honorary Air Commodore of No. 2501 (County of Gloucester) Light Anti-Aircraft Squadron, R.Aux.A.F. Regiment. Similar appointments are announced of: Viscount Templewood (No. 3604 Fighter Control Unit); Viscount Swinton (Nos. 2608 Light A.A. Squadron and 3608 Fighter Control Unit); the Duke of Portland (No. 2616 Light A.A. Squadron); the Duke of Hamilton and Brandon (Nos. 2602 Light A.A. Squadron and 3602 Fighter Control Unit); Mr. Anthony Eden (No. 3500 Fighter Control Unit); Lord Sherwood of Calverton (Nos. 2504 Light A.A. Squadron and 3504 Fighter Control Unit); and Sir Roy Dobson (No. 3613 Fighter Control Unit).

Reunions

IT is intended that the first reunion of the "dam-busting" No. 617 Squadron will be held in London in May, 1950. The reunion will be open to all past and present members of No. 617 Squadron. Those interested are asked to write to S/L. H. B. "Mick" Martin, D.S.O., D.F.C., A.F.C., Room 225, Richmond Terrace, Air Ministry, Whitehall, London.

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Those interested in a proposed reunion of all R.A.F. personnel stationed on Malta from 1940-43 are asked to contact G. W. Excell, 64, Kingston Road, Oxford.

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No. 143 Squadron reunion will be held on Saturday, December 3rd, at the Unicorn and Dukes Restaurant, 78, Jermyn St., London, S.W.1. Members of other strike squadrons are cordially invited. Particulars from J. A. Selka, 68a, Emm Lane, Heaton, Bradford.